

**Study
Report
2001-01**

Training Analysis and Feedback Center of Excellence (TAAF-X)

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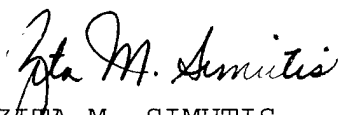
**Personnel and Training
Analysis Activities**

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FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Simulator Systems Research Unit (SSRU), conducts research and development and performs studies on training requirements for advanced training systems, devices and simulators. The SSRU provides assistance to the U.S. Army Simulation, Training and Instrumentation Command (STRICOM), and the U.S. Army Training and Doctrine Command (TRADOC) in test and evaluation activities, training requirements definition, development of device specifications, and evaluation of training equipment concepts. An important area addressed by the unit is the development of automated systems to support exercise control and feedback for collective training exercises.

The current study was conducted in response to a request from the TRADOC Army Training Support Center (ATSC) to ascertain the feasibility of having a central location support training for all maneuver combat training centers (MCTCs) and homestations equipped with an instrumentation system. A more efficient and economical means of creating and delivering high quality after action review (AAR) products is needed, not only to avoid creating large training support facilities at homestations but also to reduce the number of military personnel required to operate the Training Analysis Facility at the MCTCs. The results of this study may be used to assist in the planning of the MCTC Objective Instrumentation System and Homestation Instrumentation Training System. This work was briefed at STRICOM on 14 December 1999 to an ATSC and STRICOM audience that included Mr. Terry Faber of the Army Training Modernization Directorate and Mr. Terry Anderson representing the STRICOM Project Manager for Training Devices (PM TRADE).


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TRAINING ANALYSIS AND FEEDBACK CENTER OF EXCELLENCE (TAAF-X)
FINAL TECHNICAL REPORT

EXECUTIVE SUMMARY

Research Requirement:

The high quality of training provided for units rotating to the Army's maneuver combat training centers (MCTCs) is due, in part, to analysts using instrumentation to support observer/controllers (OCs) in the field. The Army plans to provide instrumentation for training at homestations, but it is unlikely that it can afford the same level of analytic support provided at the MCTCs. The Army Training Modernization Directorate (ATMD) Report on Live Domain Research Requirements introduced the concept of a centralized Training Analysis and Feedback Center of Excellence (TAAF-X) capable of supporting multiple MCTC and homestation exercises concurrently. ATMD requested that the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) examine the feasibility of implementing this concept.

Procedure:

The objectives of this study were to refine the TAAF-X concept, identify potential implementation problems, describe strategies for addressing problems, develop a database for wargaming implementation decisions, and estimate the overall feasibility of implementing the TAAF-X concept. We interviewed analysts and OCs from the National Training Center and the Joint Readiness Training Center to gather information concerning perceived TAAF-X benefits, implementation problems and solutions. Using this information and the TAF analysts' function analysis found in the Advanced Tactical Engagement Simulation Concepts Study (ARI Study Report 99-05), we created a TAF analyst function database to enable a decision-maker to perform "what-if" payoff analyses to resolve TAAF-X implementation problems. We also examined current programs under development and their potential impact on TAAF-X. Armed with this information we looked at whether or not the TAAF-X concept is worth pursuing.

Findings:

The refined TAAF-X concept restricts the role of TAAF-X analysts to supporting feedback through the preparation of after action review (AAR) aids and Take Home Packages (THPs). It

assumes that exercise control activities will be supported by analysts at local training sites, and these local analysts will also serve as a link between OCs and the TAAF-X. A major impediment to TAAF-X implementation is the large and growing workload of analysts. Unless this workload can be reduced through automation, we cannot expect analysts to increase their AAR and THP workloads to support additional units. We also identified a number of user acceptance problems. Current OCs and analysts are concerned that automation of AAR aid production will reduce the flexibility to tailor AAR aids for specific exercises, communications breakdowns will leave local sites without AAR aids, and sending unit performance to sites outside the unit's chain-of-command will reduce unit acceptance of the TAAF-X. The largest number of problems we identified relate to differences between the MCTC and homestation situations that make it difficult to port the success enjoyed at MCTCs to homestations. For each problem we identified at least one possible solution.

The Army's plans for a common instrumentation architecture for the MCTCs and homestations, combined with automation of AAR aid preparation will enable implementation of the TAAF-X concept. Ongoing Army efforts to reduce analyst and OC workloads through improved tactical engagement simulation and instrumentation systems also support implementation of the TAAF-X concept.

Implementing the TAAF-X concept will provide a new human link between MCTC and homestation training and improve the quality of feedback provided with homestation training, but it is questionable whether centralization of analytic functions per se will increase the number of units that can be supported by each analyst. The various strategies that would need to be implemented to support implementation of the TAAF-X concept are worth pursuing because they offer benefits in their own right (i.e., independent of the TAAF-X concept).

Utilization of Findings:

The study findings provide input for future technical and behavioral research aimed at improving the effectiveness and efficiency of training at the Army's MCTCs and homestations. This study provides a framework for the MCTC-OIS and HITS project managers to use in determining when, how, and if TAAF-X will enhance overall training. Finally, the study's database can continue to be modified as more information is obtained, more of the problems are solved, or new problems emerge.

TRAINING ANALYSIS AND FEEDBACK CENTER OF EXCELLENCE (TAAF-X)
FINAL TECHNICAL REPORT

CONTENTS

	Page
INTRODUCTION	1
Purpose	1
Study Objectives	2
Methodology	3
Terminology	4
CHANGES IN THE ARMY TRAINING ENVIRONMENT INFLUENCING THE TRAINING ANALYSIS AND FEEDBACK CONCEPT	11
Army Mission and Personnel Impacts on Training	11
Ongoing Army Efforts to Support the Trainer with Instrumentation	13
Force Modernization and the Army's Response to Modernization	15
THE REFINED TRAINING ANALYSIS AND FEEDBACK CONCEPT	19
POTENTIAL IMPLEMENTATION PROBLEMS AND POSSIBLE SOLUTIONS	27
Differences in AAR systems among sites.	27
Delays in Communications with TAAF-X.	28
Selection of AAR Aids from Standard List Reduces OC Flexibility.	29
Distractions in Homestation Training will Lead to Inefficient use of TAAF-X.	30
Unit Leaders may not Want Information About Their Unit's Performance Going to a Central Site.	31
The Need to Consider Differences in Range, Resource Constraints, and Operational Equipment Among Training Sites may Overwhelm TAAF-X Analysts	32
Procedures and AAR Techniques Vary Greatly Among Sites. ..	32
Difficult to Adjust TAAF-X Staffing to Match Workloads ...	33
Terminology for AAR Aids and Organization of TAF Cells vary Among MCTCs.	34
Potential Lack of Homestation Analyst Training.	34
Potential Lack of Homestation OC Training.	35
Lack of an OC and Homestation Analyst Habitual Relationship.	36
Lack of a TAAF-X Analyst and Homestation Analyst Habitual Relationship.	37
Potential Lack of TAAF-X Analyst Training.	38

Contents (Continued)

	Page
TAAF-X Analysts may be Overwhelmed with AAR Product Requests.....	38
Communication of AAR Requirements to TAAF-X will be Difficult if Voice is the Only Communications Media.....	39
Local Analysts will be Distracted by Requirement to Act as Link Between OCs and TAAF-X.....	40
Inexperienced OCs will Impose a Heavy AAR Aid Preparation Requirement on TAAF-X.....	41
TRAINING ANALYSIS AND FEEDBACK ANALYST TASK DATABASE.....	43
Purpose of the Database.....	43
Organization.....	43
Database Flexibility in Evaluating Strategies.....	54
FEASIBILITY OF IMPLEMENTING THE TAAF-X CONCEPT.....	59
CONCLUSIONS AND RECOMMENDATIONS.....	61
REFERENCES.....	63
APPENDIX A - LIST OF ABBREVIATIONS AND ACRONYMS.....	A-1
APPENDIX B - COMBAT TRAINING CENTER CURRENT OPERATIONS.....	B-1
APPENDIX C - CURRENT HOMESTATION TRAINING OPERATIONS.....	C-1
APPENDIX D - DATABASE INSTRUCTIONS.....	D-1

LIST OF TABLES

Table 1. Original Versus Refined TAAF-X Concept.....	21
2. Variables Used to Assess Impact of Analyst Functions on Workload.....	44

LIST OF FIGURES

Figure 1. TAAF-X methodology.....	4
2. Example sources of intrinsic feedback.....	6
3. Intrinsic feedback from a simulated direct-fire engagement.....	7
4. Example of exercise control.....	8
5. Extrinsic feedback.....	9
6. Map of some current world problem areas.....	12

Figure 7.	Army instrumentation projects that set the stage for TAAF-X concept.	14
8.	Fielding schedule for NTC-OIS and HITS-OIS.	15
9.	TAAF-X foundation established by previous ARI research.	17
10.	Division of labor in the refined TAAF-X concept. ...	24
11.	Intrinsic data collection requirements of MCTC/homestation TAF analysts.	47
12.	Extrinsic data collection functions at the MCTC TAF/homestation TAF locations.	48
13.	The number and category of problems by affected areas.	50
14.	Percent of problems by category.	50
15.	Database screen displays illustrating two different states of function satisfaction for the same strategy.	53

TRAINING ANALYSIS AND FEEDBACK CENTER OF EXCELLENCE (TAAF-X)

Introduction

Purpose

The U.S. Army maintains three maneuver combat training centers (MCTCs) i.e., the National Training Center (NTC), the Joint Readiness Training Center (JRTC), and the Combat Maneuver Training Center (MCTCs). The MCTCs are able to conduct high quality training due, in part, to analysts who leverage data from instrumentation systems to support observer/controllers (OCs) in the field perform exercise control functions and feedback functions.

Analysts use an instrumentation system to monitor exercises and alert the OCs they support to impending changes in the tactical situation and/or potential safety problems. These alerts help to ensure an OC is prepared to observe a unit's response to the situation change or intervene to avoid injury and damage. Analysts also use instrumentation to help simulate weapons effects and the activities of notional higher, adjacent and supporting units. Under the direction of OCs, analysts use their systems to prepare after action review (AAR) aids for post-exercise feedback sessions and Take Home Packages (THPs) summarizing a unit's performance over a series of exercises.

Although the Army plans to enable MCTC-like training at homestations by fielding instrumentation systems (Army Training Support Center, 1998; Department of the Army, 1999a and b), it is unlikely that the Army will have the personnel to staff each homestation with an adequate number of analysts. The Army Training Modernization Directorate (ATMD) projected the future resource needs of the live training community in the "Report on Live Environment Research Requirements" (Faber, 1996). One of the projected requirements was for a centralized analysis facility, called the Training Analysis and Feedback Center of Excellence (TAAF-X). The TAAF-X concept stated that analysts at a centralized facility will assist trainers at the MCTCs and selected homestation locations perform exercise control, AAR preparation, AAR delivery, and THP preparation functions from platoon to battalion task force level. The concept assumed that automation of exercise control and feedback functions and advanced data transmission will allow a single facility to support several, simultaneous field training exercises at

multiple locations. ATMD asked ARI to assess the feasibility of implementing the TAAF-X concept.

Two major benefits are expected to accrue from implementing the TAAF-X concept. First, the number of units that can be trained with the help of a given number of analysts should increase. The second major benefit is that using the same analysts to support MCTC and homestation training offers a means of helping to bridge the quality-gap between homestation and MCTC training.

Study Objectives

The objectives of the TAAF-X study are listed and described below.

1. Refine the TAAF-X concept. The general concept of using a centralized analysis facility to support training at multiple sites must address such variables as the range of echelons for which exercises will be supported (e.g., platoon through battalion task force) and the analyst functions to be supported from a centralized facility (e.g., exercise control, AAR preparation, THP preparation).
2. Identify and describe variables that reduce the feasibility of implementing the TAAF-X concept. This objective is concerned with identifying behavioral and technical problems likely to reduce the acceptance or value of the TAAF-X concept. Certain of these problems may be addressed by further refining the TAAF-X concept, while others may require an intervention.
3. Describe the candidate strategies for supporting the TAAF-X concept by addressing the identified problems. This objective is concerned with identifying interventions with the potential to remedy expected problems in TAAF-X implementation.
4. Design and test a TAF analyst task database for use in evaluating the TAAF-X concept and assessing the impact of TAAF-X supporting strategies. A key requirement for implementing the TAAF-X concept is to reduce current analyst workloads so that analysts can support more OCs than is currently possible.

5. Estimate the feasibility of the TAAF-X concept as a function of the ability to successfully implement supporting strategies.

Methodology

We refined the TAAF-X concept in an iterative fashion. Our initial efforts to refine the TAAF-X concept were concerned with specifying features that would be necessary to support the two major expected benefits of TAAF-X, reducing the number of analysts required to support exercises and linking homestation training with training at MCTCs. The concept was refined during attempts to address potential problems in TAAF-X implementation. That is, certain potential problems implementing TAAF-X concept were addressed by changing specific provisions of the concept.

The process of identifying potential implementation problems and solutions was accomplished in an iterative fashion. We described potential problems and solutions to OCs and analysts at JRTC and NTC, and we modified our views of problems and solutions based upon OC and analyst feedback. Figure 1 illustrates our approach.

A key part of this study was the preparation of descriptions of the current unit training processes and training environments at MCTCs and at homestations. Appendix B describes MCTC training, and Appendix C describes homestation training.

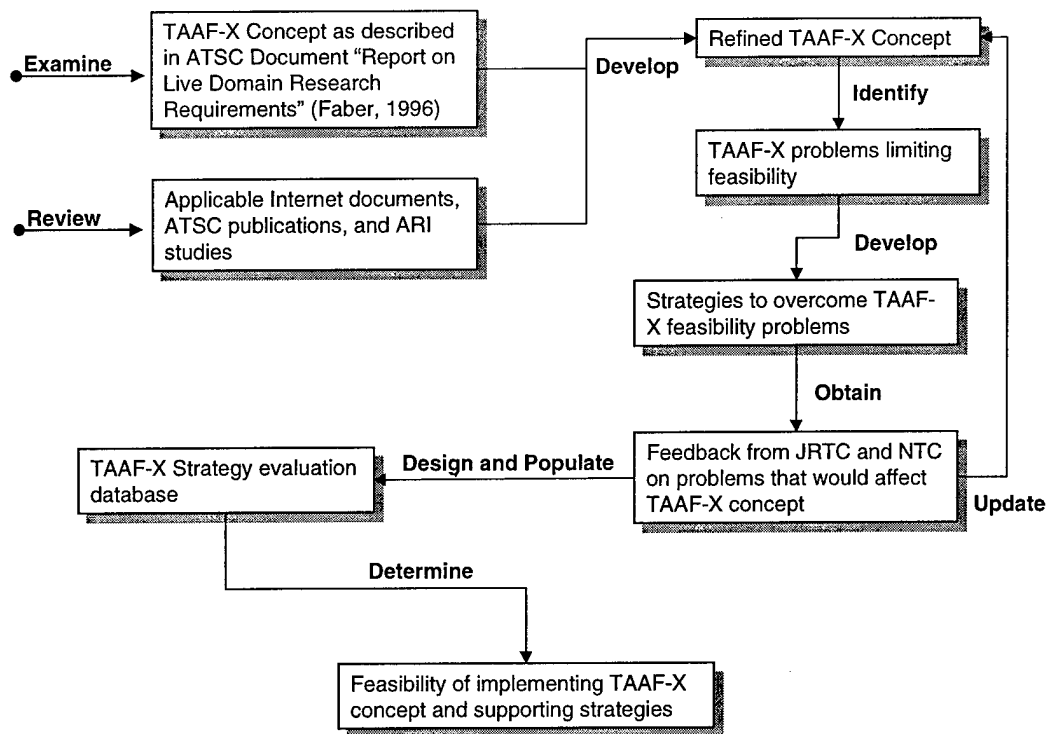


Figure 1. TAAF-X methodology.

Terminology

A complete list of acronyms used in this report is contained in Appendix A. The following terminology is used within the report.

OC

The OC is a tactically and technically competent officer or non-commissioned officer who serves as trainer, observer and exercise controller. He monitors safety, enforces rules of engagement, assesses casualties and battle damage, observes critical tactical events, performs one-on-one coaching, conducts AARs, and submits input to the training unit's THP. OCs at the Army's MCTCs perform OC duties on a full-time basis. Occasionally, personnel from tactical units, TRADOC schools and Reserve Component advisors perform OC duties to augment MCTC OCs. At homestation installations, tactical units appoint personnel who are not participating in the exercise to perform OC duties for the training unit.

Training Analysis Facility (TAF)

The TAF is a facility at each MCTC or homestation location that houses the equipment that allows the analyst to perform his job. The TAF is usually a fixed facility; however, under the Homestation Instrumentation Training System (HITS) concept, it has the capability deploy to support training in real-world theaters of operations, as needed.

Training Analysis Facility Analyst

At the MCTCs, a TAF equipped with computer workstations supports analysts who use a top-down view of the exercise, video, and player tactical voice and digital communications to observe and analyze unit performance. The TAF analyst may be an officer, non-commissioned officer, Department of the Army (DA) civilian or contracted civilian. Each TAF analyst is paired with a counterpart OC (i.e., a company team [CO/TM] analyst paired with a CO/TM OC). Working as a team, the OC and TAF analyst control the exercise, exchange observations on player activity, and identify the causes and effects that led to tactical outcomes. Before, during and after the exercise, the TAF analyst prepares AAR products to support the OC's AAR presentation. The analyst also integrates OC input and produces the THP for the training/rotating unit.

NOTE: In this report, we use the term "trainers" to refer to OCs and TAF analysts collectively.

After Action Review (AAR)

The AAR is a dynamic discussion among the friendly forces (BLUFOR) exercise players following an exercise in which the key leadership of the unit strives to determine--what happened, why it happened and how to improve performance. An AAR facilitator/leader, trainer or OC guides BLUFOR players in their discussions. In this study plan, we refer to the AAR facilitator/leader as the OC. The OC guides player discussions to establish the causes and effects that led to the tactical outcome through the use of various multimedia displays or AAR aids. These AAR aids present the tactical mission, task standards and unchallengeable "ground truths" on BLUFOR's performance.

AAR aids display the unit's plan (what was supposed to happen), identify what happened during mission execution and stimulate player discussions on why it happened. During these

discussions, exercise participants learn from their mistakes and benefit from the lessons learned by other players. The AAR, in effect, becomes the bridge between the completed training event and the next training event, providing post-exercise learning on how to improve that enables unit leaders to fix weaknesses.

Take Home Package (THP)

MCTCs provide units with a THP following their training rotation. The THPs usually consist of video, Microsoft™ PowerPoint, and paper-based products detailing the unit's rotation and the AARs it received. The purpose of the THP is to give the unit a record of its rotation and to give the unit commander a tool for conducting training on discovered weaknesses

Live Training

Live training involves soldiers using actual warfighting or training systems on real terrain to represent battlefield conditions. Live training is conducted by creating the conditions to train events or prepare for missions using actual warfighting systems in a field environment.

Intrinsic Feedback

Intrinsic feedback is "down range" feedback provided to exercise players during the exercise as they interact with their tactical systems and other players. Intrinsic feedback stimulates the senses (primarily sight and hearing) and cues the players to react to a condition or combination of conditions. For example, feedback on the location of impacting artillery provides cues to players so they may determine the accuracy of fires and the need to adjust fires. Intrinsic feedback may be real or simulated. See Figure 2.

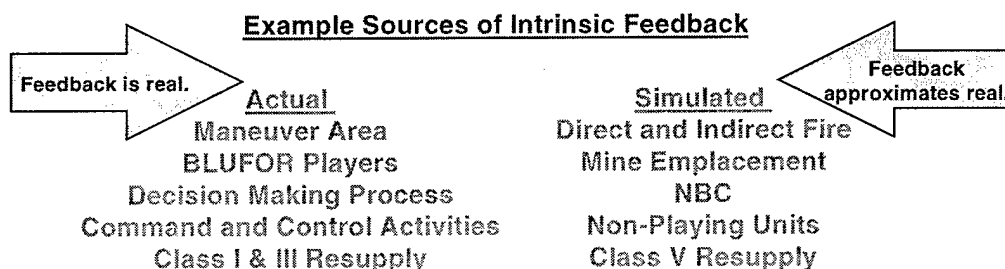


Figure 2. Example sources of intrinsic feedback.

In intrinsic feedback, actual terrain influences player maneuver; exercise players interact with other real players; commanders respond to appraisals provided by real battle staffs; staff members interact with real digital information systems. However, due to safety or cost constraints, many entities and activities are simulated, such as: the visual (flash); audio (bang); and casualty-producing effects of weapons; a notional higher, supporting or adjacent unit; and ammunition resupply. Figure 3 provides an example of simulated intrinsic feedback from a direct-fire engagement.

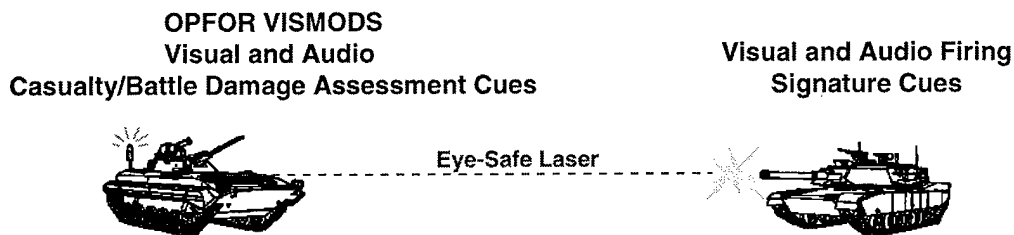


Figure 3. Intrinsic feedback from a simulated direct-fire engagement.

The live OPFOR visually modified (VISMOD) vehicle provides the BLUFOR crew the intrinsic feedback needed to distinguish enemy vehicles from friendly vehicles. The tactical engagement system (TES) simulates the flash and bang of the firing BLUFOR vehicle creating a signature for acquisition by the OPFOR vehicle. The BLUFOR vehicle TES system also emits a harmless, eye-safe laser during the engagement. Sensors on the OPFOR vehicle detect the strike of the laser beam and actuate a continuously blinking amber light simulating a vehicle kill. The blinking light informs the OPFOR crew that their vehicle is out of action and notifies the BLUFOR crew that they destroyed the OPFOR vehicle. Both the firer and the victim received real and simulated intrinsic feedback on their actions during the engagement. The firer received feedback indicating that his fires were accurate. The victim received feedback indicating that his use of cover and concealment was inadequate.

Exercise Control

When the TES system fails to provide intrinsic feedback based solely on BLUFOR and OPFOR actions, OCs and TAF analysts perform control actions to provide player personnel the needed feedback. See Figure 4 for an example of exercise control.

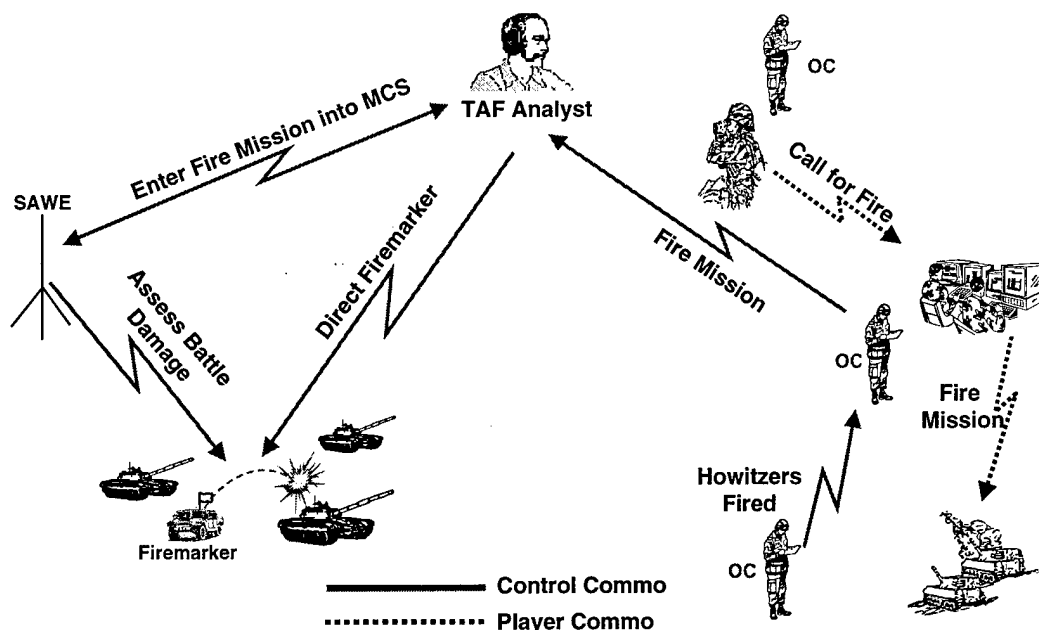


Figure 4. Example of exercise control.

The Multiple Integrated Laser Engagement System (MILES) TES system is not capable of simulating non-line-of-sight (NLOS) engagements. Consequently, BLUFOR and OPFOR actions alone will not cause the engagement nor adjudicate the results of the engagement. Figure 4 provides an illustration of the complex control procedures necessary to provide intrinsic feedback to exercise players for NLOS engagements, in this case, an artillery fire mission.

To produce the appropriate battlefield effects and battle damage/casualty assessments for indirect-fires, trainers must perform extensive control actions:

1. The OC collocated with the forward observer (FO) monitors the FO's call for fire.
2. The OC, collocated with the howitzer platoon fire direction center (FDC), observes the FDC's procedures in determining fire mission data. The FDC OC also passes the target location, projectile type, number of projectiles to be fired, and firing unit(s) to the TAF analyst for entry into the TES system--SAWE.
3. A firing platoon OC observes the actions of the howitzer platoon in laying the howitzers and preparing ammunition for the fire mission. The firing platoon OC notifies the FDC OC of whether or not the firing platoon performed all procedures correctly.

4. The FDC OC directs the TAF analyst to fire the mission in SAWE after receiving notification from the firing platoon OC that the howitzers have fired. If there are any errors by the FDC or the howitzer platoon, the FDC OC informs the TAF and the TAF analyst adjusts the point of impact for the fire mission accordingly.
5. The TAF analyst executes the mission in the SAWE control station. SAWE assesses casualties and battle damage for the fire mission and generates an indirect-fire vector on the analyst's top-down view of the exercise. Concurrently, a second analyst notifies a Firemarker to mark the location of the impacting ordnance to provide the visual and aural effects to players in the target area. NOTE: Fielding of the Direct/Indirect-fire Cue (DIFCUE) will provide aural and visual cues for indirect-fires impacting in the vicinity of mounted forces. The DIFCUE, which will be mounted on tactical vehicles, will set-off pyrotechnics when signaled by SAWE. The DIFCUE will begin fielding in FY99 (DA, 1998). However, for indirect-fires against dismounted soldiers, firemarkers will continue to use artillery simulators to simulate impacting or air-bursting ordnance.

Extrinsic Feedback

Extrinsic feedback is that feedback provided to the BLUFOR in the form of AARs, coaching and unit THPs. See Figure 5.

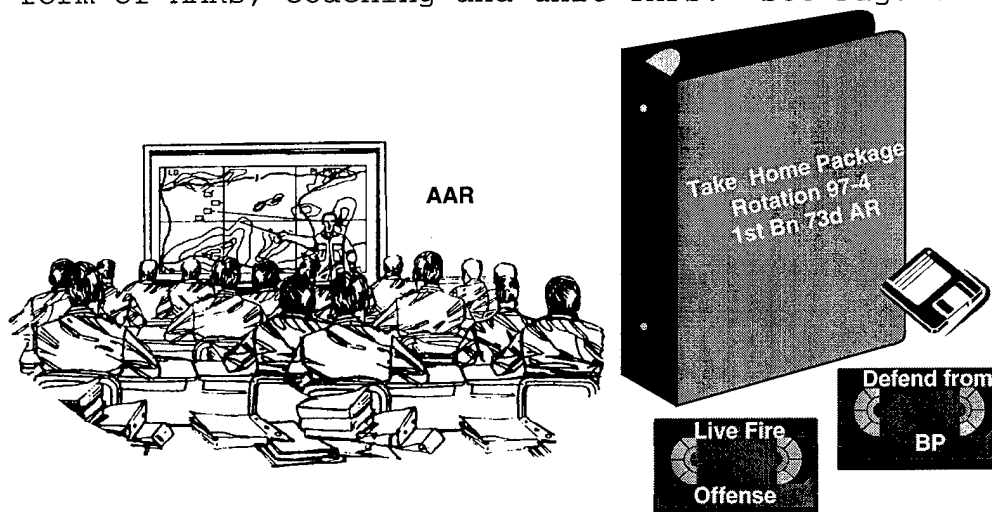


Figure 5. Extrinsic feedback.

Changes in the Army Training Environment Influencing the TAAF-X Concept

Between the point when the TAAF-X concept was first presented (Faber, 1996) and the present, major changes in the Army training environment have been initiated. These changes have a substantial impact on the need for a TAAF-X, the functions of a TAAF-X, and the feasibility of implementing a TAAF-X.

The request for this study was timely. Each of three major ongoing processes either increase the need for a TAAF-X and/or enable a TAAF-X to be implemented. First, the training workload is increasing as the Army faces rapidly evolving mission training requirements while suffering a severe reduction in personnel. The General Accounting Office (1999) recently published a study reporting a reduction in the proficiency of units arriving at the NTC for training because of these mission and personnel changes. Second, the Army is engaged in various efforts to apply instrumentation to increase the effectiveness and efficiency of live training exercises. The results of the TAAF-X study may influence the tactics used to apply instrumentation, and, at the same time, new instrumentation systems may make it possible to implement the TAAF-X concept. Third, the Army faces major changes in training requirements because of force modernization. These changes increase the need for a system like TAAF-X, and Army initiatives to help units cope with modernization have the added benefit of enabling the TAAF-X concept. The relationships of each change in the Army training environment to the TAAF-X concept are described below.

Army Mission and Personnel Impacts on Training

The national security strategy stresses preparation to defend against nuclear threats, threats from regional powers, threats to evolving democratization and regional instabilities. In the last 10 years, we have seen our armed forces in places such as Bosnia, Somalia, Haiti, Panama, Iraq, and Kosovo. In 1997 alone, Special Operations Forces were deployed to 112 countries (Tangney, 1999). This trend does not appear to be declining. Korea, Taiwan, Pakistan/India, Iraq, Iran, China, and Israel are problem areas and may require a military response at any time (See Figure 6). Peace operation deployments, in particular, have had a detrimental affect on warfighting skills and combat readiness.

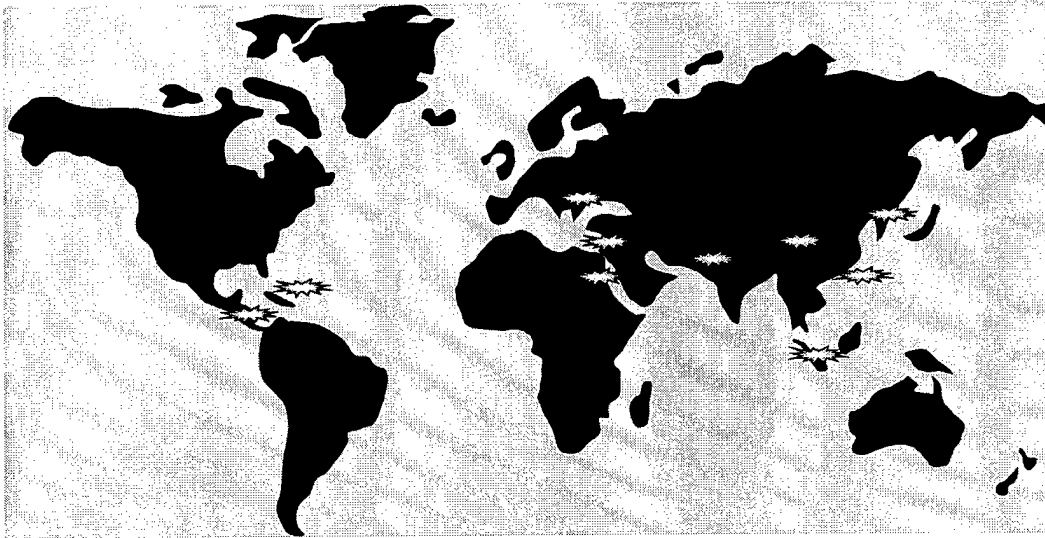


Figure 6. Map of some current world problem areas.

With sudden and frequent deployments, scheduling for MCTC rotations has become increasingly difficult. When a unit scheduled for a MCTC rotation is called for a "real world" mission, another unit must take its place. Many times the swap occurs near the MCTC rotation date, giving the replacement unit little time to prepare and causing the training to not be as effective as when a unit is able to properly prepare for a rotation (Advancia, 1999b).

In addition to a stringent operating tempo (OPTEMPO), personnel turbulence has contributed to the erosion of combat readiness. Due to the importance placed on an NTC rotation, units are "stabilized" - do not lose people - for up to six months prior to a rotation. Because of the stabilization, there is usually a mass exodus from the unit upon return from the rotation (Lynch, 1999). A unit's personnel turnover after a MCTC rotation virtually negates any collective lessons learned and the utility of the exercise THP. While the principles outlined in the THP do not change, the soldiers (leadership traits, experience, level of training, etc.) do change.

Force structure changes that occur more and more frequently add to training challenges. The Army has gone from Army of Excellence to Army XXI to Army After Next. It has pursued lighter forces, then heavier forces. Presently, the new Chief of Staff, General Shinseki, has embraced the Fast Strike Force/Medium Brigade concept. This is a brigade-sized medium task force that can completely deploy by air to a crisis area within 96 hours. The emphasis will be on rapidly deploying a lethal combat force consisting of lighter armored vehicles and

gun systems to fight future conflicts and win. All of these structure changes have dictated changes in the way the Army conducts training. This presents a major challenge to units because they take on the task of designing, testing, and refining training strategies for new task structures and missions.

Finally, fiscal constraints have played a major role in the ability of units to conduct training. The past seven years have seen a reduction of over 50% of all military and DA civilians. Military members are frequently seen performing duties other than training. The philosophy of "train as you fight" has become increasingly difficult to apply.

Clearly, improved homestation and "in-theater"/deployed training capabilities are needed to counter these readiness detractors. Training strategies must prepare units to take full advantage of the MCTC's vast combat training capabilities, and maintain their training proficiency at homestation or when deployed. The solution, therefore, is to provide units with a MCTC-like capability to conduct quality training at homestation or when deployed. The TAAF-X concept proposes a way to provide this capability without having to build and man full-blown MCTC facilities at multiple locations (Faber, 1996).

Ongoing Army Efforts to Support the Trainer with Instrumentation

Current live homestation training is uninstrumented and largely unprepared to take advantage of the skills of a training analyst. The Army has already prepared a requirements document for an instrumentation system that can provide homestations with a MCTC-like capability. This instrumentation will provide an electronic data stream that allows a properly equipped analyst to support training. The decision regarding how these systems will be staffed with analysts remains to be made. Staffing may involve temporarily assigning unit personnel to the job, using unit personnel to staff a relatively permanent training support cadre, or applying a refined TAAF-X concept. It is unlikely that the Army will provide units with new slots designated for analysts.

Similarly, the maneuver MCTCs are not in a position to take advantage of a centralized analyst facility. Although these MCTCs are instrumented, a unique software system is required to analyze the electronic data stream from each MCTC. TRADOC and STRICOM have recognized the need to standardize instrumentation systems across the MCTCs. An important Army goal is to ensure

that the next MCTC in line for an instrumentation upgrade, the NTC, receives a system that can serve as the model for all future live instrumentation systems, including the one to be fielded at homestations.

Requirements documents for both MCTC and homestation instrumentation systems define the need for instrumentation systems that can reduce significantly the work required to prepare AAR aids (Department of the Army, 1998b; Hanford, 1999; Heath, 1999; Project Manager for Combat Support Training Systems, 1998). To some unknown degree, automation will reduce the workload of analysts. Under the TAAF-X concept, we view this as an opportunity to increase the number of exercises an analyst can support.

As illustrated in Figure 7, implementation of the MCTC-Objective Instrumentation System (MCTC-OIS) and HITS makes it possible to consider implementing the TAAF-X concept. Without MCTC-OIS and HITS, TAAF-X would not be feasible.

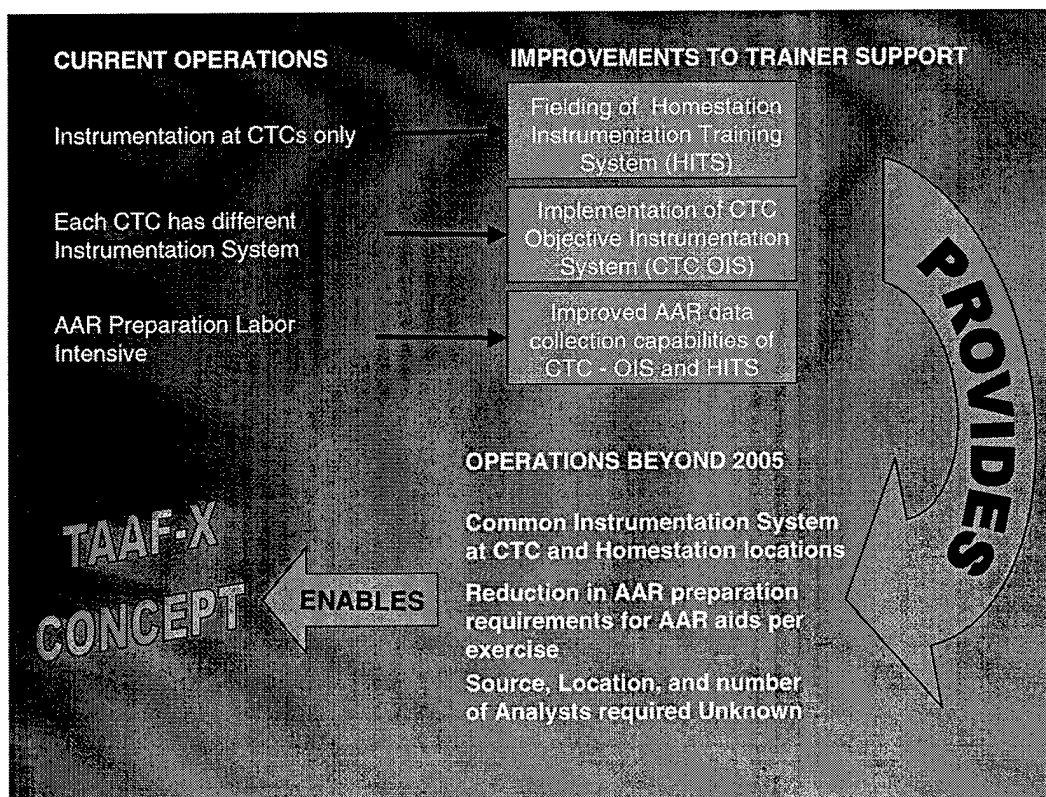


Figure 7. Army instrumentation projects that set the stage for TAAF-X concept.

As shown in Figure 8, the MCTC-OIS and HITS will not be fielded for several years; however, it is possible that adoption of the TAAF-X concept may influence the approaches taken to implement MCTC-OIS and HITS. The Army wants to avoid a situation where extensive post-development re-engineering of HITS and MCTC-OIS is required to accommodate the TAAF-X concept.

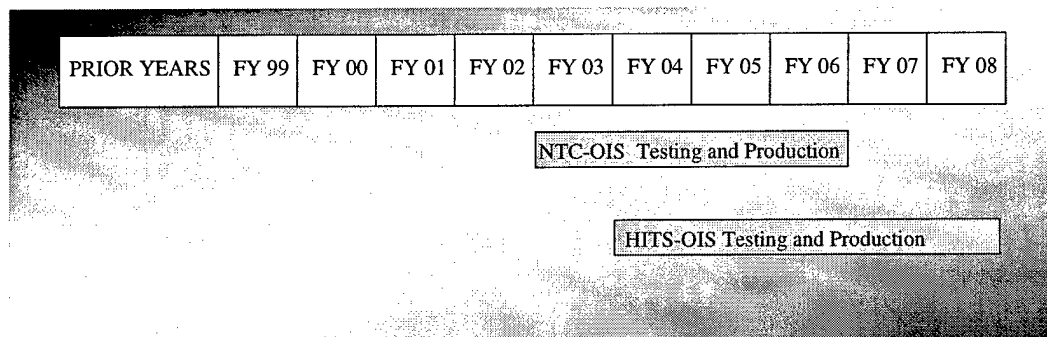


Figure 8. Fielding schedule for NTC-OIS and HITS-OIS.

Force Modernization and the Army's Response to Modernization

Force modernization, and the Army's response to it, have multiple relationships with the TAAF-X concept. Modernization substantially increases the need for a system like TAAF-X, while the Army's response to the demands of modernization helps to enable implementation of the TAAF-X concept.

Force modernization includes: new weapon systems; reconnaissance, surveillance, and target acquisition (RSTA) systems; and digital command, control, and communication systems. The Army is fielding a large number of operational systems over the next fifteen years under the rubrics of Force XXI and Army After Next (AAN). The Army Science and Technology Master Plan (DA, 1997, 1998a) describes systems and capabilities to be fielded.

Faber (1996) envisioned the need for a series of behavioral and technical studies to support future live training. Training Analysis and Feedback Aids (TAAF Aids), performed in FY 1997, was the first study in this series. The TAAF Aids Study (Brown, Nordyke, Gerlock, Begley II, and Meliza, 1998) examined 140 new and emerging weapon, digital and RSTA systems to identify their impacts on the jobs of OCs and analysts at the MCTCs. This study described what OCs and analysts would have to do to support the simulation of these new systems and to collect data regarding unit employment of these systems as input for AARs. In addition, TAAF Aids described OC and analyst duties in

preparing AARs and THPs. This study concluded that OCs and analysts would be unable to support the workload associated with these new systems, in the absence of any interventions. The TAAF-Aids study described a situation that needed to be addressed before a TAAF-X could be implemented. That is, analysts will be burdened with too many requirements to even consider trying to employ a TAAF-X.

In the next three studies, ARI defined strategies for addressing the increases in workload.

- The Advanced Tactical Engagement Simulation Concepts (ATESC) study focused on exercise control and data collection workloads associated with weapon and RSTA systems (Brown, Anderson, Begley II, and Meliza, 1999b). This study provided a database that weighted the impact of new and emerging systems on OCs and analysts in terms of such variables as time required to perform tasks, tendency for tasks to overwhelm OCs and analysts with duties, and expected gaps in feedback. Fifteen high level strategies for using automation to assist OCs and analysts were envisioned and the value of implementing each was assessed using the OC and analyst task database.
- The Cognitive Requirements for Information Operations Training (CRIOT) Study (Brown, Anderson, Begley II, and Meliza, 1999a) defined the capabilities a workstation would need to help OCs and analysts perform exercise control and feedback functions associated with digitized units.
- The Advanced After Action Review Media (A3RM) Study was concerned with identifying problems in preparing AAR aids and THPs and describing strategies for addressing these problems (Brown, Anderson, Begley II, and Meliza, 1999c). This study provided many concepts for using automation to reduce the AAR preparation workload of OCs and analysts.

The four studies described above set the stage for the TAAF-X study. Analysts will be overwhelmed by exercise control and feedback requirements as new systems are fielded. To the extent that the US Army implements strategies for reducing OC and analyst workloads, the TAAF-X concept becomes more feasible. Figure 9 illustrates how implementing the responses to force modernization described in the ATESC, CRIOT and A3RM studies can enable the TAAF-X concept by reducing analyst workloads and providing an electronic capability that can support automated AAR aid preparation.

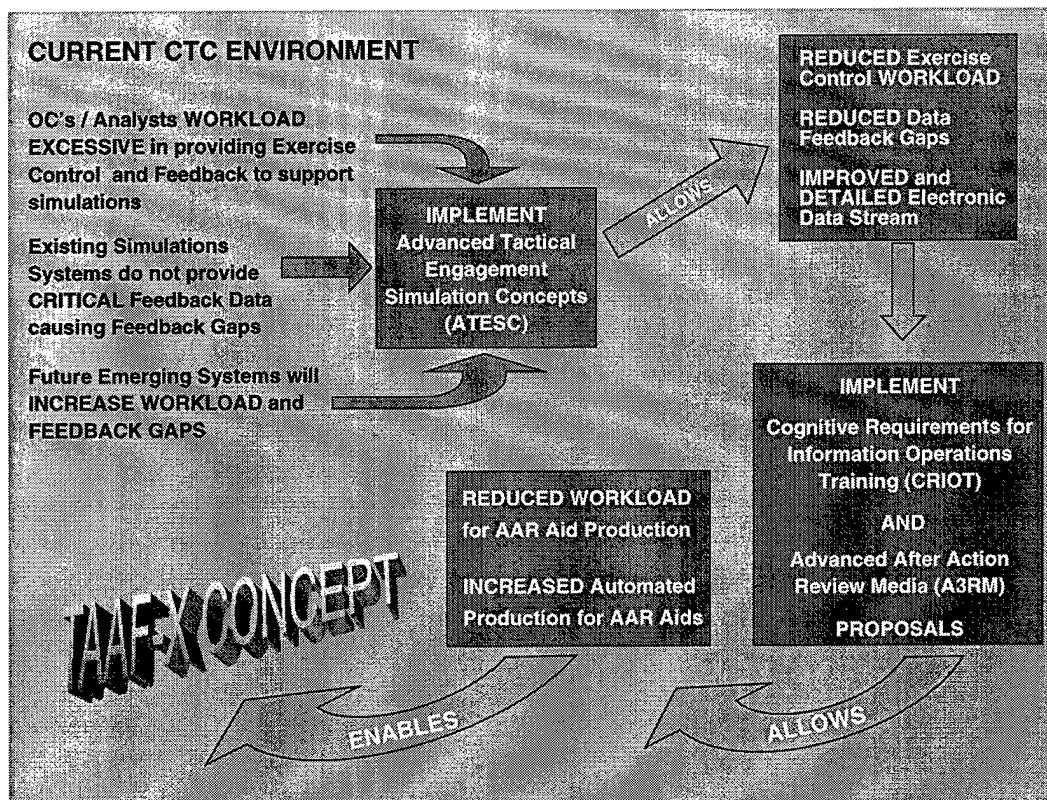


Figure 9. TAAF-X foundation established by previous ARI research.

Force modernization influences the TAAF-X concept in another way, in that it increases the need for a TAAF-X. The first units to try out new equipment face the need to develop tactics, techniques and procedures (TTPs) for using this equipment. To a large extent, TTP development in the past has been guided by lessons learned at the MCTCs. MCTCs provide a world class opposition force, training areas, instrumented ranges, and experienced OCs and analysts to support TTP refinement; however, the role of MCTCs in testing and refining TTPs has been restricted somewhat by the fact that new systems are fielded at selected homestation sites long before they are fielded at the MCTCs. The first time MCTC OCs observe many of the new systems is when units rotate to the MCTC. Homestation sites are generally less prepared to support TTP testing and refinement with respect to new systems. Instrumentation of homestations and support of homestations by trained analysts may help to address this shortfall. The TAAF-X concept offers the

potential benefit of ensuring the analysts supporting homestations are experienced and linked to the MCTCs. One might reasonably expect that the TAAF-X analysts will learn much about the peculiarities of employing new systems supporting these units at homestation before they rotate to the MCTCs.

The Refined Training Analysis and Feedback Concept

After performing the literature search, conducting interviews at JRTC and NTC, and obtaining input from ARI and ATSC experts, the Team created a refined TAAF-X concept. This concept calls for a permanently staffed, centralized facility that will assist trainers at the MCTCs perform AAR preparation, AAR delivery, and THP preparation functions from CO/TM to brigade combat team (BCT) level. The same centralized facility and personnel will concurrently assist trainers at selected homestation locations perform AAR preparation, AAR delivery, and THP preparation functions from CO/TM to BN/TF level.

The refined concept assumes:

1. The TAAF-X concept assumes that analyst workloads will be reduced substantially from current levels by improvements in TES systems and automation of the AAR aid preparation process.
2. The TAAF-X must allow analysts to support multiple exercises concurrently, allow analysts to support both a MCTC and homestation site, and/or improve the quality of homestation training. The TAAF-X concept is enabled through the application of automation, but the benefits of implementing a TAAF-X must go beyond automation. TAAF-X benefits must accrue through the act of centralizing analytic functions.
3. The relationship between TAAF-X and a MCTC may differ from that between TAAF-X and a homestation training site. MCTCs will remain the proving ground for TTPs as well as providing capstone training exercises.
4. There is a need for a TAF manned with permanent analysts not only at the MCTCs, but also at homestations.
5. Communications infrastructure will be in place capable of handling all communications needs between the MCTCs and TAAF-X and the selected homestations and TAAF-X.
6. HITS analysts will interface with OCs at homestation and with TAAF-X analysts.
7. TAAF-X will have the capability to integrate live, virtual and constructive training.

8. When MCTC TAF analysts/homestation analysts enter information on their workstations, that information must be visible/usable to the TAAF-X analyst at the centralized facility on his workstation.

The objectives for the refined TAAF-X concept are:

1. Ensure a means to provide realistic dynamic training at both homestations and MCTCs with a net reduction in training personnel.
2. Provide standardized procedures and products for exercise control and feedback for live or integrated training strategies (live, virtual, and constructive).
3. Provide a single training and analysis feedback facility to support one or more field training exercises at multiple locations simultaneously; e.g.,
 - one exercise with participants at a MCTC and homestation(s), or
 - multiple exercises at various locations.
4. Provide a single training analysis and feedback facility to produce AAR products and THPs.
5. Provide exercise control and AAR input and review from MCTCs and homestations.

The refined concept differs from the original concept in several ways. Table 1 points out what the differences are and the reasons for those differences.

Table 1.

Original Versus Refined TAAF-X Concept

ORIGINAL CONCEPT	REFINED CONCEPT	REASONS FOR DIFFERENCES
<p>...analysts at a centralized facility... The original concept does not specify whether these analysts will rotate in and out of the position or will be permanently assigned.</p>	<p>...permanently staffed centralized facility analyst</p>	<p>Permanent staffing will ensure standard, quality AAR products, avoiding the need to train new personnel every exercise bloc/year/etc. NTC just recently had an 80% turnover in military OC/TAF analysts (Advancia, 1999b).</p>
<p>... perform exercise control, AAR preparation, AAR delivery, and THP...</p>	<p>... perform AAR preparation, AAR delivery, and THP...</p>	<p>Exercise control functions should remain at the MCTC and homestations. This is primarily intended as a safety measure in the event of long-haul communications failure between the centralized facility and the MCTC or homestations . With TAAF-X's potentially remote location from the exercise site, communications failure may compromise training safety if the control function remains with the TAAF-X.</p>

ORIGINAL CONCEPT	REFINED CONCEPT	REASONS FOR DIFFERENCES
<p>...TAAF-X will assist trainers at the Maneuver Combat Training Centers (MCTC) and selected homestation locations... from platoon (PLT) to battalion task force (BN/TF) level.</p>	<p>... TAAF-X will assist trainers at the MCTCs ... from company/team (CO/TM) to brigade combat team (BCT) level. The same centralized facility and personnel will assist trainers at selected homestation locations from CO/TM to battalion task force (BN/TF) level.</p>	<p>BCTs train at the National Training Center, so TAAF-X must be able to handle BCT level exercises. According to OCs and TAF analysts at NTC and JRTC, the lowest level for AAR support from the TAF should be CO/TM (Advancia, 1999a, 1999b).</p>
<p>The concept assumes that there is a need for a TAF at the MCTCs manned with analysts. The status of the analyst is not specified.</p>	<p>The refined concept assumes there is a need for a TAF at the MCTCs manned with permanent civilian analysts.</p>	<p>Since there are currently permanent civilians at the MCTCs performing TAF analyst duties, and since OCs at the MCTCs are military personnel stationed at the MCTCs for one to four years, this arrangement should not be changed. This particular arrangement allows for rapport between the analyst and the OC to develop, allowing for a more efficient operation - reduced AAR preparation and editing time.</p>
	<p>OCs interface with local analysts; local analysts interface with TAAF-X analysts.</p>	<p>Since TAAF-X analysts may support multiple exercises simultaneously, or may support multiple local analysts in the same exercise, span of control dictates</p>

ORIGINAL CONCEPT	REFINED CONCEPT	REASONS FOR DIFFERENCES
		that OCs interface with local analysts and not directly with TAAF-X analysts.
	When MCTC TAF/homestation analysts enter information on their workstations, that information must be visible/usable to the TAAF-X analyst at the central facility on his workstation.	MCTC TAF/homestation analysts must enter various types of information (such as obstacle location, NBC information, etc.) in order to make effects assessments. This information must be instantly available to the Central Facility TAAF-X analyst for use in AAR preparation. Without it, the AAR products will be greatly lacking in critical information.
	TAAF-X supports integrated live, virtual and constructive training exercises.	Resource constraints and growing Army participation in Synthetic Theater of War require the ability to leverage the training support afforded by TAAF-X.

The refined TAAF-X helps clarify MCTC and homestation responsibilities and is more detailed than the previous concept. The refined TAAF-X concept assigns functions that the TAAF-X TAF analysts are responsible for, clarifies the roles of the analysts at the local TAF, specifies the echelons supported at MCTCs and homestations, and establishes assumptions necessary to make the TAAF-X viable. Figure 9 shows the division of labor between and among the OC, TAF Analyst, and TAAF-X analyst.

Analysts and OC Duties Under Refined TAAF-X Concept

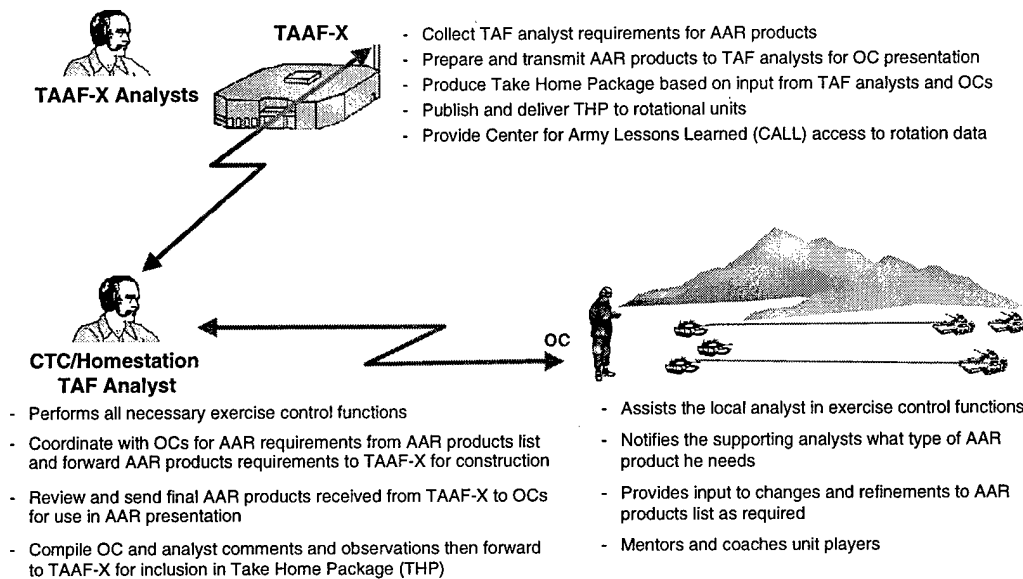


Figure 10. Division of labor in the refined TAAF-X concept.

Figure 10 shows how duties may be divided in the refined TAAF-X concept as described above. The local TAF analyst ensures the exercise runs smoothly by performing all necessary exercise control functions such as adjudication of exercise casualties, coordination with the unit directing the exercise, etc. In other words, exercise control functions will remain the same as are currently being performed at the MCTCs, but will occur at both MCTCs and homestations. OCs will also retain their exercise control functions such as exercise safety issues, performing manual engagement adjudication, etc.

When the OC notices an event that he wants to capture during the AAR, he sends his request to the local TAF analyst that is supporting him. The OC and TAF analyst discuss the content needed to construct the AAR aid. The local TAF analyst then contacts the TAAF-X analyst that is supporting him, relaying the OC's request. The TAAF-X analyst creates the product and sends it back to the local analyst for approval/edit. The local analyst contacts the OC and informs him of the requested product. The OC either accepts or edits the product. These actions continue until the OC approves the product. Once approved, the TAAF-X analyst places the product in a bin for AAR presentation. Each TAAF-X analyst places their product into the same bin, organizing the bin as they go.

At change of mission, TAAF-X sends the AAR package to the local TAF for presentation by the OCs. The TAAF-X analyst, at the end of the rotation, takes the AAR products and creates a THP. After the TAAF-X analyst creates the THP, it is sent to the unit that participated in the rotation. CALL will have access to the data TAAF-X collects for its trend analysis and lessons learned publications.

The TAAF-X concept has the potential to provide significant benefits. The expected benefits of implementing the TAAF-X concept are described below.

Help insure that high quality AAR products will be available at each site. Experts in AAR aid preparation will be available at TAAF-X to provide guidance regarding AAR aid employment and to actually prepare AAR aids.

Link MCTC and homestation training. TAAF-X analysts will be current regarding performance problems being demonstrated by units rotating to MCTCs and regarding AAR aids being used to address these problems in the AAR.

Potential of reducing the number of personnel and facilities required to support the training of a unit. Gaining this benefit will require scheduling training in a way that allows TAAF-X to avoid the lulls in activity associated with specific training sites. This will allow the time of analysts and facilities supporting analytic activities to be used in a more efficient manner.

Reductions in the costs of software upgrades. Rather than upgrading AAR software at every MCTC and homestation training site, the AAR system need only be upgraded at TAAF-X. The significance of this benefit increased when we considered the number of AAR system upgrades that may be required to keep pace with digitization of the battlespace. As the individual components of the Army Battle Command System (ABCS) continue to evolve, we expect to see periodic changes in the versions of the component systems, like the Maneuver Control Station (MCS).

Help to manage requirements for future AAR system upgrades. Rather than each separate training site trying to keep track of requirements for upgrades discovered when using instrumentation systems and find funding for upgrades, the TAAF-X concept provides a focal point for examining requirements across sites and funding upgrades. Providing all training site with the same instrumentation systems does not meet this need, because the

needs at each training site will begin to diverge from those at other sites without at least some level of control over how AAR aids are produced and used.

Potential Implementation Problems and Possible Solutions

In the initial stages of the overall analysis, we concentrated on determining the potential problems that would prevent implementation of TAAF-X. During the analysis it became evident that some problems were associated specifically with the MCTCs, while others were specifically associated with the homestations. Additionally, we found that some problems were common to both locations.

An assumption we made before addressing problems was that training analysts and OCs will know how to use the automation equipment they will be required to operate. Additionally, we assumed they would receive at least an introduction in what their particular jobs entail. Without this basic understanding, it will be virtually impossible for units to conduct meaningful TAAF-X supported training. The problems and solutions described below were developed through discussions and feedback from OCs, analysts, and subject matter experts when briefed during visits to the NTC and JRTC.

Problems and strategies play an integral part in the refinement of the concept. As the decision-maker selects strategies to solve problems, those strategies translate into new capabilities for the concept and changes in the duties and responsibilities of the personnel. Obviously, the selection of the problems to solve and the strategies to solve them will cause the concept to evolve.

Analysts Lack Time to Support Additional Units

As mentioned earlier in this report, analysts are already busy supporting exercise control and feedback functions, and their workload will increase as a function of force modernization. Asking analysts to support more training sites and/or OCs does not make sense unless we can first reduce analyst workloads.

Strategy 1: Implement automation strategies described in the ATESC, CRIOT and A3RM reports.

Differences in AAR systems among sites

The MCTCs currently have different software systems that support collection of data from the TES/IS. Under the TAAF-X concept, the TAAF-X facility will receive TES/IS data being sent from the MCTCs. To be able to do this under current MCTC

conditions, the TAAF-X would have to maintain three separate hardware/software systems. Additionally, they would have to track changes or modifications made to each MCTC system and then update theirs to ensure the systems are compatible. The maintenance and upkeep of the systems to keep TAAF-X current with modifications made at the MCTCs would be nearly impossible. The Instrumentation Officer at NTC stated that "many times he has had to configure the IS and software that supports it during the exercises" to overcome problems. Additionally, the TAAF-X system must have standardized operating systems that support all MCTC TES/IS requirements with a stable and reliable network. At NTC there have been communications "blackouts" due to weather. At the time the NTC personnel quickly repaired the problem with minimal effects, BUT that is because they could fix the problem on site. This would not be possible with a communications loss between the TAAF-X and the MCTC. The use of a common operating system would allow for easy upgrades and changes in configuration of the system. If an upgrade was required using a common system, then the TAAF-X would simply transmit the upgrade from their location and the user would execute the change on their system. The implementation of a common system must be installed before TAAF-X is attempted to ensure all locations are supported equally.

Strategy 1. This problem will be addressed with the fielding of the MCTC-OIS.

Delays in Communications with TAAF-X

Current operations at the MCTCs allow TAF analysts to produce automated AAR products in support of OCs during unit rotations. This process, despite being labor intensive, allow the TAF analyst to produce AAR products independent of others to support unit exercises. The TAF analyst can manipulate the data at his workstation to display needed views of the battle. The TAF analyst can manipulate audio clips from the audio capture station, and required video clips from the video capture station for AARs within the TAF cell. The TAAF-X concept proposes taking the responsibility for producing AAR products from the MCTCs and placing the requirement at a centralized TAAF-X facility. This process will make the MCTC TAF analyst totally dependent upon TAAF-X for AAR products. OCs and TAF analysts are very concerned about access to the TAAF-X analysts that support them and the ability of TAAF-X to deliver timely AAR products. Their concern about access to the TAAF-X analyst was that there may be trouble "getting in contact" with them considering so many other locations would be supported

concurrently by the TAAF-X analyst. Additionally, the TAF analysts and OCs are concerned about alternatives if there is a communications failure between the TAAF-X and the MCTC location. In the case of a communications failure they would have NO capability to support the BLUFOR units and OCs with AAR products. The general opinion of the TAF analysts and OCs was that shifting the responsibility for AAR products to a remote site like TAAF-X would reduce their ability to support the BLUFOR units during rotations. Of course, this is an issue for homestation locations as well.

Strategy 1. Provide an automated system at the MCTCs with limited AAR production capability, such as statistical aid creation and PowerPoint for text slides.

Strategy 2. Require each OC to create his own AAR product for inclusion in the AAR. Equip him with a laptop, presentation software and a way to send/receive e-mail. He would create his products and send them to the AAR facility for senior OC review and inclusion/deletion.

Selection of AAR Aids from Standard List Reduces OC Flexibility

The TAF analysts and OCs at NTC and JRTC were very concerned about losing their capability to create AAR products "as needed". The OC and TAF analysts saw the concept of only having the option to select specific types of AAR products from a list as reducing their flexibility and effectiveness. Additionally, they stated that with every rotation they come up with a new requirement for an AAR aid that is different from what they have on file. The TAF analysts were concerned that they need the capability to tailor their aids to the specific event. In many instances the TAF analysts stated that they constructed a top-down view AAR aid, and then would modify the aid by adding graphics and text questions that would support the OCs focus of the AAR aid. The TAF analysts also commented that no matter how comprehensive the proposed standardized AAR aid list could become, there would still be a need to modify the AAR aid to support and clarify the OCs specific intent for the AAR presentations. The TAF analysts stated that the AAR process was highly fluid in the preparation phase in support of the OC. The inability to modify the AAR products in a timely manner before AAR presentations as required would reduce the quality of support to the trained units.

In discussions with the OCs and TAF analysts at NTC they commented on how they used certain AAR aids consistently for AAR

presentations. They stated that they consistently use five types of AAR aids. Additionally, all TAF sections have their own set of "cookbooks" with AAR aid templates for a variety of AAR aids. Recently, the TAF analysts stated that the "cookbooks" are now stored in the computer. This allows the TAF analyst to quickly access the AAR template required, change any information as needed, then insert the AAR product into the PowerPoint AAR presentation. This process has allowed the production of certain AAR aids to become an simple "cut and paste" procedure. NTC TAF analysts and OCs stated that to list all the possible AAR aids available for every TAF cell at the MCTCs would result in a list of thousands of AAR products. Additionally, they stated that with every rotation they come up with a new requirement for an AAR aid that is different from what they have on file. The TAF analysts and OCs were very concerned about losing their capability to create AAR products "as needed". The OC and TAF analysts saw the concept of only having the option to select specific types of AAR products from a list as reducing their flexibility and effectiveness.

Strategy 1: The automated system for preparing "standardized" menus of AAR aids should be given an editing capability that matches the variety of changes OCs are likely to make.

Strategy 2: Be prepared to have TAAF-X analysts spend up to a certain portion of their time preparing requested, unique AAR aids for an exercise. (The OC requesting the aid could possibly identify a new type of aid that TAAF-X adopts if it meets an information need not being met by existing aids.)

Distractions in Homestation Training will Lead to Inefficient use of TAAF-X

The units plan training in cycles based on the green, amber and red time management system as stated in Field Manual (FM) 25-100 (Department of the Army, 1988) and FM 25-101 (Department of the Army, 1990). This system specifies what should be the priority of training during each cycle. During the green training cycle, units focus on collective task training at multi-echelon unit levels. The unit maximizes soldier participation in mission essential task list (METL) training during the green cycle. Priority of training resources such as major training areas, local training areas, and key training ranges are provided to units in the green cycle and administrative support requirements are kept to a minimum. A homestation unit in the green cycle should be totally dedicated to training collective tasks that support the METL. Typical

activities during a green cycle include gunnery qualifications, field training exercises, combined arms live fire exercises, and planned rotations to one of the MCTCs. The green cycle will also be the logical place for commanders to schedule the use of TAAF-X for training at homestations. Despite the use of long and short range planning, units still have distractions that affect training. During discussions with TAF analysts they stated that training distractions are increasing, further reducing unit training time. A Senior OC at the NTC stated that "there used to be three training cycles (green, amber, red) now there are only two, red and green". In one instance, a unit had trained, prepared and spent resources for their "warfighting" NTC rotation only to be diverted for peacekeeping duty in Bosnia. This is a drastic example, but the same process could happen when scheduling training with the TAAF-X facility. Personnel shortages, reduction of training funds, and increased OPTEMPO for units has increased the training distractions in units at all levels.

Strategy 1. TAAF-X can use down time resulting from cancellation of exercises to prepare lessons learned reports in cooperation with CALL.

Strategy 2. Reinforce the chain of commands commitment to reduce training distractions at all levels within units. Leaders from the Division Commander level down to Squad Leader level should put more emphasis on training, ensuring nothing interferes with planned training.

Unit Leaders may not Want Information About Their Unit's
Performance Going to a Central Site

The MCTCs protect information on the results of unit performance. They purposefully remove unit identification information before sending exercise data to CALL. Similarly, although not sent to CALL, homestation training performance information stays in command channels at the homestation location. Protecting unit anonymity under the TAAF-X concept will required a well thought out process. The TAAF-X will have unit data from all over the world, and these data could inadvertently become compromised without the proper technical and procedural safeguards.

Information created at a remote location and sent over some type of long-haul communications network concerning unit performance may be of concern to commanders. With the

transmissions of the AAR specific data and the data stream from the TES and IS there is an increased potential for unit specific performance to be compromised.

Strategy 1. Encrypt all data from the IS, TES, and MCTC TAF/Homestation TAF workstations.

Strategy 2. Run dedicated lines from TAAF-X to all supported installations.

Strategy 3. Use both Strategy 1 and Strategy 2.

The Need to Consider Differences in Range, Resource Constraints, and Operational Equipment Among Training Sites may Overwhelm TAAF-X Analysts

TAAF-X analysts at the maneuver MCTCs are highly familiar with the terrain on which exercises are conducted. They know, for example, that if a unit selects certain routes of advance, then the unit is likely to be engaged early by the OPFOR. Armed with this knowledge, OCs and analysts will be prepared to observe and illustrate key unit actions for the AAR. Under the TAAF-X concept, an analyst is likely to be supporting exercises on terrain that is largely unfamiliar to the analyst. An analyst may even be required to support two such exercises concurrently.

Strategy 1: Restrict the number of training areas with which each analyst normally works.

Strategy 2: Prepare database with training area specific information (locations normally used for defensive positions, etc.).

Strategy 3: Limit the number of exercises an analyst supports during a given period to one.

Procedures and AAR Techniques Vary Greatly Among Sites

The MCTCs currently have distinct differences in the types of AARs presented. These differences have become institutionalized at each location as the standard for AAR presentations. Additionally, the AAR presentation content varies based on the style and personality of the Senior OC. AAR presentations often vary at the same MCTC based on the OC teams involved. This causes inconsistent training feedback in

supporting units trained. The presentation of AAR information can be tailored to fit the personality of the Senior OC, but the functional *CONTENT* and *PROCEDURE* for AAR presentations at all MCTCs and homestations should be the same. With the advent of the TAAF-X concept, the disparity between MCTCs on presentation standards will become a problem. It will be extremely inefficient for the TAAF-X analysts to be required to "track" presentation standards and required AAR aids if they are different for each MCTC. The standardization of the AAR presentation process across all MCTCs will improve the efficiency of the TAAF-X analyst duties in supporting the MCTC TAF analyst. Additionally, this process will improve the consistency of feedback received by the units trained. The extension of this standardization process to the homestations will also ensure that homestation AAR presentations are conducted to one standard. A standard AAR process would avoid allowing the homestations the opportunity to create their own different unique AAR procedures and enhance the efficiency and effectiveness of TAAF-X analysts

Strategy 1. Coordinate with MCTC and homestations to determine a standard presentation sequence for AARs. Train all OCs and TAF analysts in AAR presentations in the same manner.

Strategy 2. Re-establish AAR presentation guidelines and doctrinal formats to ensure specific procedural requirements are maintained.

Difficult to Adjust TAAF-X Staffing to Match Workloads

Staffing of maneuver MCTC TAFs is currently adjusted to match workloads by having analysts work long days during rotations and then providing compensatory time off between rotations. During rotations, staffing is also adjusted so that more analysts are available during mission execution and fewer are available during planning and preparation phases. Long work days make it possible for the same analyst to track unit performance during a mission and then participate in the AAR preparation process after ENDEX. Sustained involvement with the same unit also helps the TAAF analyst contribute to THP preparation. These patterns of analyst involvement will be hard to duplicate in a situation where an analyst may be required to support multiple training sites, with sites differing in terms of the day on which field training is initiated and the start times for specific exercises. JRTC analysts suggested that it may be necessary to run three eight hour shifts of analysts at a TAAF-X to address the loss of the ability to employ the massed

workload/compensatory time strategy. This naturally creates problems providing analyst continuity in terms of supporting specific units and specific exercises.

Strategy 1: Create a TAAF-X cell for each exercise, coordinating local analyst duty times and manning with TAAF-X duty times and manning.

Strategy 2: Man the TAAF-X around the clock, using a three or four-shift rotation of personnel with equal numbers of analysts in each shift.

Terminology for AAR Aids and Organization of TAF Cells vary Among MCTCs

Currently, the MCTCs are organized differently at each location. There is no common terminology used to describe AAR products across MCTCs. With the implementation of TAAF-X, all AAR products will be constructed at a centralized facility. The TAAF-X personnel cannot be trained to understand terms for three different MCTC locations plus all of the homestations when referring to AAR products. For example, an AAR product showing an animation of the units moving in an engagement is called a "hyper" AAR aid at NTC. The same type AAR aid at JRTC is called a "flip book" AAR aid. The problem of standardization extends to the organizations of TAF cells at the MCTCs. Each TAF cell structure at the separate MCTCs is different. The TAAF-X organization must support each MCTC and it would not be cost effective to support the MCTC TAF organizations separately.

Strategy: The standardization of the terminology and organizations of the TAF cells at the MCTCs and homestations will improve the TAAF-X's ability to support all units.

Potential Lack of Homestation Analyst Training

TAF analysts at the MCTCs are trained in AAR aid construction and exercise control in support of weapons simulation at their specific installation. The analysts' training includes the use of the analyst workstation, use of the Observer Controller Communications System (OCCS), construction requirements for AAR products, exercise control requirements to simulate weapon systems, and the use of the audio and video capture station. TAF analyst training occurs on site and the TAF analyst may require a number of rotations to become proficient at his job. The need for trained and competent TAF analysts at the homestation is critical since they communicate

homestation requirements to the TAAF-X. There is currently no training program organized to train homestation TAF analysts. In order for homestation training with TAAF-X to be successful there must be competent TAF analysts at homestations.

It is important to note, that lack of training for homestation analysts is not a problem limited to TAAF-X. The use of any instrumentation, such as the HITS, to support training at homestation will be influenced by the degree of analyst training. Currently, there are no TAF analysts at the homestation locations, however, with the fielding of HITS, they must come from somewhere. The TAF analysts who support HITS may be selected from units in the RED training cycle on the installation. The personnel selected for the TAF analyst requirement will not have any training in the use of the system or the duties of a TAF analyst.

Strategy: Homestations should provide continuity in terms of the personnel tasked to serve as local analysts to reduce the costs associated with analyst training.

Potential Lack of Homestation OC Training

Personnel assigned as OCs at the MCTCs receive formalized training as they arrive at the specific installation. The new OC attends an OC training academy that ensures that the individual is able to coach, mentor, and train units during the MCTC rotations. This training includes all aspects of conducting meaningful AARs, availability of AAR products and TAF support, and familiarity with the MCTC training areas, as a minimum. Additionally, the new OC at the MCTCs usually observes one rotation with an assigned mentor to see how to conduct actual operations. After the formal classroom instruction and observing two rotations with an assigned mentor the new OC is trained and ready for duty. Each MCTC standardizes its own formal training process. The homestation OC training situation is different. There is no formal OC training being conducted at homestations. If any OC training is done, it usually is not standardized across the installation. This lack of formalized training makes the proficiency of the OC dependent on his own experience. Often unit personnel selected for OC support are the subject matter experts in their area. This ensures the OCs are knowledgeable of the subject, but does not ensure they will be good OCs. Without training, the OC may not be effective in providing feedback to the unit for AAR purposes. Additionally, they may not know what is required for the conduct of a good AAR presentation. Without formal training, the OCs at homestation

will not be able to relate properly with local analysts and will be unable to provide consistent feedback to the training units. The NTC TAF analysts stated their workload would increase if they had to work with untrained OCs.

This problem is not limited to TAAF-X implementation. Local OC training will be a problem regardless of whether TAAF-X is implemented. Fortunately, the TAAF-X concept per se is intended to support these OCs and help them perform their jobs. The challenge facing TAAF-X is make sure that local analysts are prepared to receive help.

Strategy: At a minimum, homestation OCs should receive a brief introduction to the types of AAR aids available from TAAF-X and their utility (e.g., traces of unit movement provide a fast way to show a unit wandered or backtracked during movement).

Lack of an OC and Homestation Analyst Habitual Relationship

Personnel are assigned as OCs at the MCTCs for a minimum of two to three years. Additionally, the majority of the TAF analysts at the MCTCs are civilian contractors with some stability and experience in the position. This system allows the OC and TAF analyst to become familiar with each other during their assignment at the MCTC. The TAF analyst becomes familiar with the OCs priorities in observing units and can anticipate the need for specific AAR products. After working with the OCs, the TAF analyst may know, for example, that the OC always wants a top down view AAR product showing the units positions when crossing the line of departure. In this case the TAF analyst would automatically construct the AAR without causing the OC to request it, thus saving time for the OC. The experience of the TAF analyst also is critical in anticipating problem areas based on the terrain of the MCTC. This may translate into knowing that there are communications problems in certain areas in the training area. The TAF analyst will anticipate potential problems with communications, observe, and possibly produce AAR products based on how the unit reacts to overcome the problems. The OCs that support homestation exercises are currently not trained as OCs, and only perform their duties for the duration of the exercise. The homestation instrumentation training system (HITS) currently does not address manning of the system by analysts. This could potentially mean that both the OC and TAF analyst at homestation could be temporary, and only be together for the duration of the exercise. This makes the advantages of a habitual relationship impossible to achieve. This will also increase the workload in communications between

the OC and homestation analyst to support the units needs for AAR products. The untrained homestation analyst may have problems effectively communicating AAR product requests to the TAAF-X analyst. Additionally, if the homestation analyst is temporary there is no possibility to build an experience base and reputation for competence in the job. This will cause turbulence and lack of confidence in the analyst and reduce the effectiveness of training support to units. The TAF analysts and OCs at the NTC stated the habitual relationship between them is helpful in streamlining operations but not a critical requirement.

Once again, this problem is not unique to TAAF-X. This problem will also surface if units employ homestation instrumentation without a TAAF-X. The problem may even be reduced somewhat if the TAAF-X concept is employed, because the experienced TAAF-X analyst can help guide the relationship between OCs and local analysts.

Strategy: Assigning personnel to work as local analysts for extended periods will help to alleviate this problem.

Lack of a TAAF-X Analyst and Homestation Analyst Habitual Relationship

The Homestation Instrumentation Training System (HITS), as planned, will not have dedicated analysts assigned to the systems at the selected homestations. The system will be "manned" with OCs and analysts selected from units on the installation for planned field exercises. Unless the installation manages this personnel process to support HITS, TAF analysts will seldom be the same from exercise to exercise. This will not allow the TAAF-X analyst to form any relationship with the HITS analyst over time. A consistent relationship between the homestation analyst and the TAAF-X analyst could save time on communication of AAR product needs. As the TAAF-X analyst gets used to working with specific homestation analysts he could anticipate the homestation analysts needs for specific AAR products. This relationship would be beneficial in cutting the communications required to specify exactly what the AAR product should look like and the information it should contain. The constant flow of new homestation analysts for every exercise will cause the TAAF-X analyst to spend more time in getting detailed information on AAR requirements than if the HITS analysts changed less frequently. Despite the potential for this to be a problem, the OC and TAF analysts at NTC stated that they did not think the problem would be hard to overcome.

Potential Lack of TAAF-X Analyst Training.

The TAAF-X analyst must be trained to support the MCTC and homestation analysts. The TAAF-X analyst must be knowledgeable in the use of all the equipment found at the MCTCs and homestation locations. Depending on the homestations being supported by TAAF-X, the variety of equipment being used by the exercising units may be formidable. Although not crucial to the analyst's duties, a general knowledge of the force structure of the exercising unit may be helpful in anticipating the types of AAR products the local TAF may request and the points in the exercise in which he may request them. This type of information could be available in a formal training program. Additionally, the TAAF-X analyst must be an expert in the use of his equipment. The OPTEMPO of the exercises he will support is such that he must know the products available, the operation of the AAR equipment, and know when to ask clarifying questions. Finally, he must be prepared to assist the local analyst in cases where the local analyst has no or little experience in performing as an analyst. There must be a formalized program to ensure that the TAAF-X analyst is trained to perform these functions.

TAAF-X Analysts may be Overwhelmed with AAR Product Requests.

Currently it takes approximately 15 minutes to create a snapshot, top-down view AAR aid. During certain phases of the battle, several MCTC and homestation analysts may be requesting AAR product support from the TAAF-X analyst at the same time. The MCTC and homestation analysts could be requesting multiple AAR products of the same type or a number of different AAR product types. The TAAF-X analyst must respond to the information to support the AAR requests and could get overwhelmed. To illustrate how the TAAF-X analyst could get overwhelmed let's use the example of a TAAF-X analyst supporting three MCTC/homestation analysts at the same location. While supporting the three MCTC/homestation analysts, the TAAF-X analyst receives a request for three AAR products from MCTC analyst # 1. While taking information to support specific AAR needs for MCTC analyst # 1, the TAAF-X analyst receives a call from MCTC analyst # 2. for five AAR products. At this point the TAAF-X analyst asks MCTC analyst # 2 to wait. The TAAF-X analyst finishes gathering information from MCTC analyst # 1 information, then takes the information from MCTC analyst # 2, and begins working on AAR products. Next there is a call from MCTC TAF analyst # 3. To take the required information from the

MCTC TAF analyst # 3, the TAAF-X analyst must stop work on the other requests. A pace like this could easily cause the TAAF-X analyst to make mistakes in AAR production, and could easily overwhelm him. The end result is a degraded ability to support the AARs at the MCTCs and homestations.

Strategy 1: Disperse start times for exercises assigned to a TAAF-X analyst or TAAF-X analyst cell to minimize overlap during the most frantic AAR aid preparation periods

Strategy 2: Provide tools to help TAAF-X analysts track AAR aid preparation activities for multiple exercises concurrently

Strategy 3: Provide some level of AAR preparation capabilities at local training sites (local analysts will need workstation to perform exercise control functions)

Communication of AAR Requirements to TAAF-X will be Difficult if Voice is the Only Communications Media

The TAF analysts at the MCTC and future homestation locations will receive requests for AAR products from a number of different sources. The primary requests will come from supported OCs, but they may also receive requests from the Senior OCs. Currently, the OCs at the MCTCs speak directly to the TAF analysts and they identify the type AAR product required and what it should contain. The TAF analyst ensures it is produced. The TAF analysts at the NTC stated that often it would take the combined effort of the military and civilian analyst listening to the OCs request to clearly determine exactly what the OC wanted on the AAR product. TAAF-X will require the OCs at the MCTCs and homestation to request AAR products from a local analyst who will attempt to relay the specific AAR requirements to the TAAF-X analyst. The TAAF-X analyst will then construct the AAR aid. The OCs and TAF analysts at NTC stated that it would be more time consuming to add the requirement of explaining their AAR needs to an additional person. They were unanimous in feeling that it would slow the process down and add confusion in establishing specific AAR product needs.

Strategy: Videoteleconferencing capabilities would improve the communication capabilities among OCs, local analysts and TAAF-X analysts.

Local Analysts will be Distracted by Requirement to Act as Link
Between OCs and TAAF-X

Currently, MCTC TAF analysts produce their own AAR products. The TAF analyst has the flexibility of producing AAR products to support the OCs as needed during any portion of the exercise. When the OC requests an AAR product, the MCTC TAF analyst makes it. The coordination is simple and the process is efficient because the OC and TAF analyst are used to working with each other and are located at the same installation. Additionally, when the MCTC TAF analyst sees a critical event as it occurs at the workstation, he can immediately take action to get what is needed for the AAR product.

With the implementation of TAAF-X, the MCTC TAF analyst will not be able to capture events at the workstation to produce AAR products. Instead, he will have to capture the event and then request the TAAF-X to construct appropriate AAR products. The TAF analysts that we interviewed stated that moving the responsibility for producing AAR products to the TAAF-X would not save time or effort on their part. The TAF analysts felt that in the time it would take to explain the specific requirements for their AAR products to the TAAF-X analyst, they could construct it on their own at their location. Additionally, the MCTC TAF analyst and the homestation HITS TAF analyst will compete for the TAAF-X analyst's attention. The MCTC TAF and homestation TAF analyst will have to take time to explain his location, what unit he is wanting the AAR aid for, the type AAR aid needed, and any text that is needed for the aid. During this coordination process with the TAAF-X analyst, the MCTC/homestation TAF analyst will not be observing the current battle and may miss critical events that occur. This additional coordination required for AAR products also takes the MCTC/homestation TAF analyst away from exercise control duties during battle engagements. This problem will be difficult enough for an experienced MCTC TAF analyst to overcome, and will be much more difficult for an untrained TAF analyst at the homestation. An untrained or partially trained homestation TAF analyst could easily become overwhelmed trying to support engagements with these coordination requirements. The coordination requirements for the THP and its construction are not as time sensitive as AAR products during a battle, but they are critical to unit support. The MCTCs currently have personnel designated to support the production of the THPs. These personnel readily interface with OCs and analysts to clarify intent and needs for the THP. This coordination is currently easy since all required personnel are at the same

location. The implementation of the TAAF-X concept would make this face to face coordination impossible. The process of explaining specific requirements to personnel at the TAAF-X for AAR products and THP production will be difficult and time consuming.

Strategy: Videoteleconferencing capabilities would improve the communication capabilities among OCs, local analysts and TAAF-X analysts.

Inexperienced OCs will Impose a Heavy AAR Aid Preparation Requirement on TAAF-X

Large numbers of AAR products are produced, but fewer than 30% are actually used. This is due, in part, to the fact that OCs often do not know the specific topics to be addressed in the AAR until the exercise is near completion and the most critical aspects of unit performance can be decided. Many AAR aids are produced just in case they will be needed for the AAR. At the MCTCs, each TAF cell supports the Senior OC with AAR products for his AAR presentation at BCT/BN TF level. At the MCTCs, the Senior OCs AAR is the most automated AAR presentation conducted. There are automated AAR products produced in limited quantities to support CO/TMs, as requested, and occasionally at PLT, as possible.

The Senior OC and newly assigned OCs have a tendency to request more AAR products during exercises than they may use during the AAR. The TAF analysts in supporting the Senior OCs have a tendency to make more products to ensure "they comprehensively support" the Senior OC. This process seems to settle down after newly assigned personnel complete a couple of rotations and become more comfortable with the entire process. One TAF analyst stated that each new Senior OC reviews the TAF analysts' cookbooks and designates AAR products they want to consistently use during the AAR. The TAF analysts stated that often they include "additional" AAR products as options for the Senior OC to consider. When the Senior OC screens these additional products he frequently does not use them. This process is time consuming and causes more work in preparation for the AAR than is needed. As OCs become more experienced they tend to focus on aids that have proven useful. At homestations where there is the likelihood to have untrained OCs, the problem of making "more" products than required is worse. The homestation locations do not have permanent OCs and do not go through the same "learning process" that MCTC OCs do in the

selection and use of AAR products. One may find that these inexperienced OCs request a large number of aids to play safe or leave it to TAAF-X analysts to anticipate their needs and provide them with candidate aids to select among. In either case, the impact on the analyst can be a heavy workload.

Training Analysis and Feedback Analyst Task Database

Purpose of the Database

The TAAF-X Analyst Task Database is a tool to evaluate and assess the effects of proposed strategies on the feasibility of the TAAF-X concept. The database allows the user to evaluate strategies that will increase the feasibility of implementing the TAAF-X concept by determining their overall effect on the workload of the TAF analysts at the MCTC/homestation locations. Additionally, the database allows the user to prioritize strategy analysis. The database is a tool that gives the user an indication on how a specific strategy or a combination of strategies will assist in reducing workload and solving problems associated with TAAF-X implementation. The TAAF-X Analyst Task Database's function is to give the decision-maker a tool that he can use to evaluate strategies that could assist in implementing TAAF-X. The database allows the user to add/delete/modify:

- TAAF-X objectives
- MCTC TAF/homestation TAF analyst functions
- Problems associated with TAAF-X implementation
- Strategies to fix or mitigate those problems

Additionally, the database is a wargaming tool for the decision-maker. Depending on his perspective and priorities, he can wargame which plan meets his needs. The database does not identify an "approved" solution.

Organization

Basic Data Structure

We used Microsoft™ Access 97 and Microsoft™ Excel to create the database. By definition, we knew we had to look at problems implementing the TAAF-X concept and strategies to overcome those problems. After reviewing associated literature, we believed it would be beneficial for the user to know whether or not his strategies for problems met any of the TAAF-X objectives. In order to evaluate the amount of workload reduction taking place by implementing certain strategies, we decided to use functions analysts must perform to accomplish the strategies. In summary, below are the four areas the database addresses:

- Functions
- Problems
- Objectives
- Strategies related to Database Functions

Analyst Functions

In order to capitalize on work we had previously done, we imported the functions from the ATESC Study (Brown et al., 1999b). The study covered OC, analyst and firemarker duties required to provide effective simulations and feedback for emerging systems during force-on-force engagements. These duties were referred to as control and feedback (CAF) functions and included the OC and firemarker actions required to provide realistic simulation feedback. The ATESC study proposed 14 high level concepts that eliminated or reduced OC/analyst/firemarker functions, and eliminated gaps in intrinsic and extrinsic feedback. In the TAAF-X analysis, we selected ATESC concepts that directly affected the OC and TAF analysts' workload for consideration as strategies. We eliminated functions associated with the firemarkers and all OC functions that did not require an interaction between OCs and analysts. We added functions bridging the interactions between OCs and local analysts and functions required for AAR product requests, creation of AAR products, adjustment and dissemination of AAR products from the TAAF Aids study. This gave us a finite list of functions that were totally associated with the analysts' workload. Additionally, there were some changes made to the database to identify functions as MCTC TAF analyst functions and homestation TAF analyst functions, allowing us to specify the functions and their requirements. Each function has a score associated with it that we call the workload score for that particular function.

We analyzed the functions analysts must perform to provide effective exercise control and feedback to the players. The objective of the analysis was to determine the workload expended for each function. Our analysis followed three basic steps:

1. We analyzed MCTC TAF/homestation analyst and TAAF-X analyst functions, and estimated each function's duration, repetition, complexity, and training and personnel requirements. We refer to these estimates collectively as analyst function characteristics.

2. We estimated the impact of the function on the analyst's capability to observe, analyze, request and create AAR products. For example, when a MCTC TAF/homestation TAF analyst contacts the supporting TAAF-X analyst, he may have to take several minutes explaining the type of AAR product his supported OC wants. While he is talking to the TAAF-X analyst, his ability to concentrate on the exercise is degraded. The more complex the request, the longer it will take to convey the OC's requirements.
3. We estimated the potential of the function to overwhelm the analyst. For example, if each MCTC TAF/homestation analyst supports six OCs, and each TAAF-X analyst supports three MCTC TAF/homestation analysts, there is a potential for the TAAF-X analyst to be overwhelmed if all 18 OCs want products for different parts of the battle at the same time.

Table 2 lists the variables we considered in assessing the impact of each function on the analysts (Advancia, 1999c). The variables helped us identify the major aspects that comprise the functions. The table depicts the scoring criteria and weights we assigned to each variable. Notice, we weighted function characteristics by 1 (variable no. 1). However, we heavily weighted those variables with the potential to distract or overwhelm the analyst (variables no. 2-3). The effect of the scoring and weighting methodology is that the variables in 1 are of equal importance, and variables 2 and 3 are of greater importance, as the weightings attest.

Table 2

Variables Used to Assess Impact of Analyst Functions on Workload

Variable	Scoring Criteria	Weighting
1. Function Characteristics		
1a. Function completion time	Less than 1 minute = 1 2 - 5 minutes = 2 6 - 10 minutes = 3 11 - 20 minutes = 4 21 - 30 minutes = 5 1 - 60 minutes = 6	x1
1b. Number of times function performed by one person during an exercise	1 time = 1 2 - 5 times = 2 6 - 10 times = 3 More than 10 times = 4	
1c. Function complexity	Cognitive = 5 Human computer interface = 4 Human coordination = 3 Navigation = 2 Physical action = 1	
1d. No. of personnel who perform the function (The functions under analysis are individual functions vice collective functions. This variable addresses the average no. of trainers who perform the function during an exercise. For example: TAF Analysts create statistical AAR products, but there may be 18 analysts who perform this function during an exercise.)	1 - 2 persons = 1 3 - 5 persons = 2 6 - 10 persons = 3 More than 10 Persons = 4	
1e. Function training requirement	Has required Skills = 0 Less than 1 hour = 1 2 - 4 hours = 2 5 - 8 hours = 3 9 - 40 hours = 5 41 - 80 hours = 10	
2. Function's potential to distract trainer from observation or analysis duties	No distraction = 0 Distracted less than 1 minute = 1 Distracted 2 - 5 minutes = 3 Distracted 6 - 10 minutes = 5 Distracted more than 10 minutes = 7	x5
3. Function's potential to overwhelm trainer	None = 0 Little = 2 Moderate = 5 High = 10	x5

To determine the need for additional functions/duties of the MCTC TAF analyst, homestation TAF analyst and TAAF-X analysts, we re-evaluated the CAF study's intrinsic and extrinsic TAF analysts' data collection requirements. In Figure 11 we see the intrinsic functions required for the MCTC and homestation analysts to support the simulation of the Crusader Howitzer.

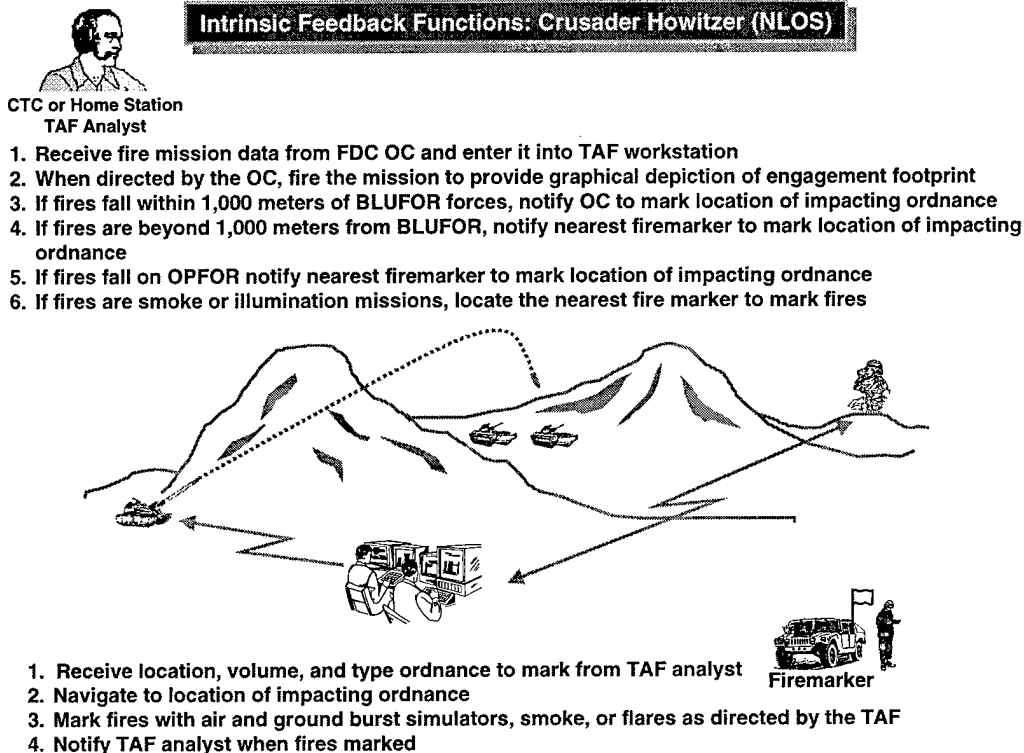


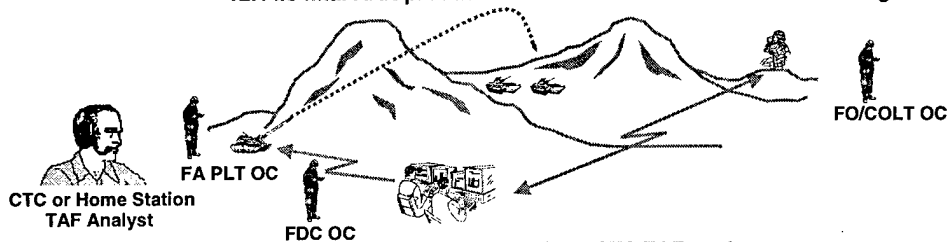
Figure 11. Intrinsic data collection requirements of MCTC/homestation TAF analysts.

Under the refined TAAF-X concept, the exercise control requirements for force on force engagements will be accomplished locally. In Figure 11 we see that there are some intrinsic functions the MCTC/homestation TAF analyst must perform to support the engagement. Although the MCTCs have always had to provide exercise control, under TAAF-X, homestations will also have to provide exercise control to include control capabilities that support the HITS TES/IS. Figure 12 below shows the additional extrinsic functions associated with extrinsic data collection at the MCTC TAF and homestation TAF locations.

Extrinsic Feedback Functions: Crusader Howitzer (NLOS)



1. Receive and clarify exact AAR aid requirements from CTC TAF analyst
2. Locate required AAR aid engagement in exercise history
3. Identify and locate any voice communications required
4. Identify and locate any video clips as required
5. Scale/zoom the map to display required engagement
6. Verify display of appropriate BLUFOR control measures
5. Prepare AAR aid as requested by CTC TAF Analyst
6. Prepare audio communications as required
7. Prepare video clips as required
8. Title the AAR aid as directed by the CTC TAF Analyst
9. Transmit final product to CTC TAF Analyst for review
10. Correct AAR aid as required based on CTC TAF Analyst review
11. Transmit corrected AAR aid to CTC TAF Analyst as required
12. File final AAR product used for later use in Take Home Package



1. Receive and clarify exact AAR aid requirements from CTC TAF analyst
2. Contact TAAF-X Analyst and request OC AAR aid requirements
3. Receive completed AAR aid products and forward to OC for review
4. Transmit AAR aids that need correction to TAAF-X analysts and clarify actual corrections require
5. Receive Final AAR aid from TAAF-X and forward to OC

Figure 12. . Extrinsic data collection functions at the MCTC TAF/homestation TAF locations.

In Figure 12 we see the extrinsic functions required for AAR aid production. These functions indicate the involvement required at the MCTC/homestation TAF level and the TAAF-X location. When we removed the OC and firemarker functions from the original CAF data, there were a total of 84 functions associated with the MCTC/homestation TAF analysts, and 54 functions associated with the TAAF-X analyst. All tasks associated with the MCTC/homestation TAF and the TAAF-X TAF analyst were analyzed and assigned a workload score. For a list of functions used within the database for analysis, see Appendix F.

The workload scores associated with the functions are based on using trained personnel. As stated previously, without training homestation analysts, homestation OCs and TAAF-X analysts to be proficient in the use of their automated tools and to know at least the fundamental requirements of their other duties, units will gain little training benefit from TAAF-X.

Potential Problems Implementing TAAF-X

During the analysis, we identified TAAF-X problems and proposed strategies that would assist in increasing the feasibility of implementing the TAAF-X concept. While conducting the analysis of TAAF-X problems, we noticed that some problems were more critical than others. We also noticed that we were able to categorize the urgency of the problem in three groups. The weighting system allows the user to determine what problems should be solved first based on workload scores. Additionally, we arbitrarily assigned a minimum percentage of workload reduction to consider the problem sufficiently "solved". The categories, weights and minimum workload percentages are:

- Critical, 10. A problem is assigned this category when the TAAF-X concept will be impossible to implement effectively if it is not addressed. We arbitrarily decided that to satisfactorily solve all critical problems, 50% of the associated workload must be reduced. The user may assign any workload percentage he deems necessary to effectively solve the problems.
- Serious, 5. A serious problem is one that will cause delays, disruptions, and confusion during the exercise, either in exercise control or AAR preparation/presentation. By itself, the problem does not make implementation impossible, but it does create undo hardships. The arbitrary suggested amount of workload reduction is 40% for serious problems.
- Annoyance, 1. A problem is an annoyance when it has little impact on exercise control or AAR preparation/presentation itself but may cause undo workarounds by the analysts. To solve annoyances, we arbitrarily decided that 10% of the associated workload must be reduced.

An additional criterion we developed to distinguish problems was whether the problem effects were unique to the MCTCs, homestations, or had an affect on both. Since homestations do not currently have an automated training system, we assigned a value of 10 to those problems only affecting homestations. MCTCs already have a system so a problem implementing TAAF-X at the MCTCs would not be as critical, thus we assigned those problems a value of 5. If the problem affected both homestations and MCTCs, we assigned it a value of 15, adding the values from both MCTC and homestation.

After completing the list of problems and defining and categorizing them, we found that two were specifically related to the MCTCs, four to homestations and five related to both (see Figure 13).

Problem Summary

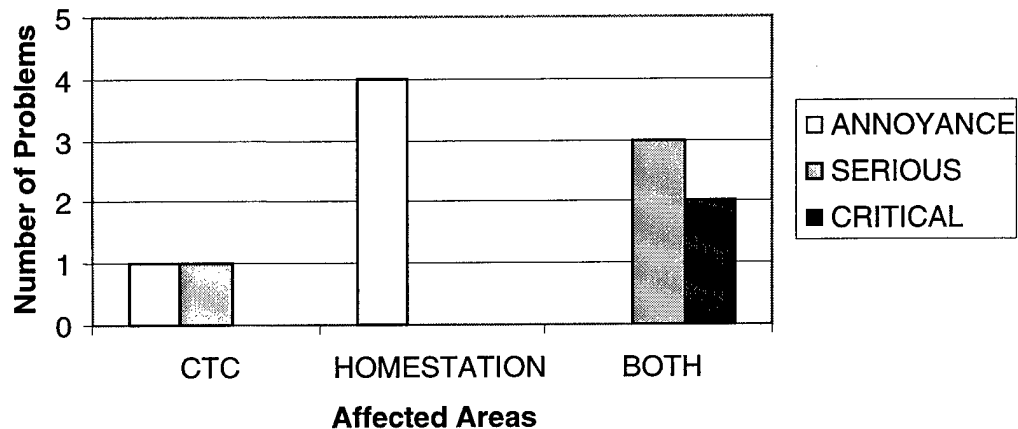


Figure 13. The number and category of problems by affected areas.

Of the 11 problems:

- 18 percent were critical
- 36 percent were serious
- 46 percent were annoyances (see Figure 14)

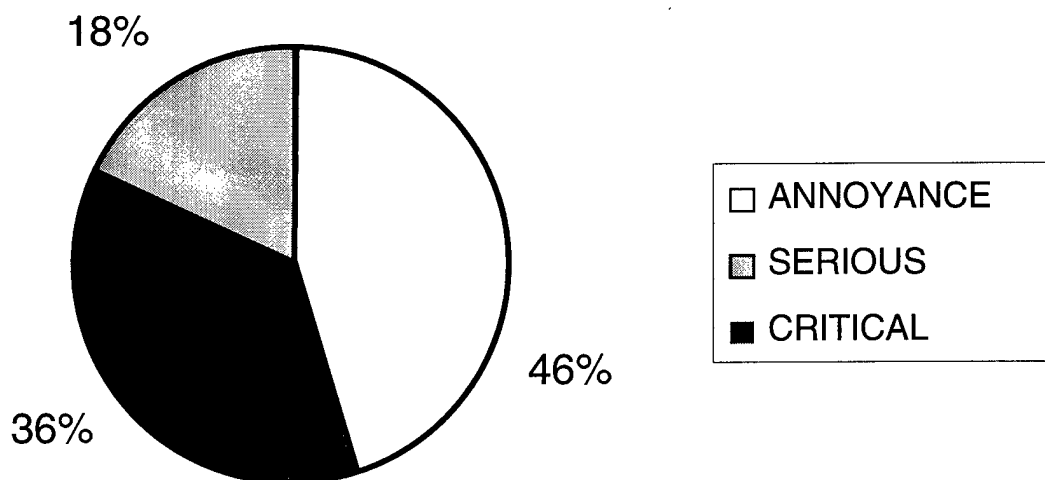


Figure 14. Percent of problems by category.

See Appendix F for each problem and associated area.

Objectives of TAAF-X Implementation

We investigated what the objectives were for TAAF-X, including them in the database to allow the user to ascertain whether or not his strategies meet the objectives. A list of the five objectives may be found in Appendix F.

Strategies for Addressing Implementation Problems

Strategies are solutions to problems. Most of the strategies originated in the ATESC and CRIOT studies. We also devised other strategies that had the capability of assisting in the solving of TAAF-X problems. Many of the strategies use automation as their basis for assisting in problem resolution. A list of the 30 strategies may be found in Appendix F.

Groupings of Data

After populating the database with the basic information, we organized the information into logical groups. These groupings are:

- Functions and Strategies
- Objectives and Strategies
- Strategies and Problems

Functions and Strategies

We took each strategy and went down the list of functions, associating functions that would either be assisted by the strategy or would be completely satisfied by the strategy. The category of assisting or satisfying allowed us to weight the strategy based on the amount of workload it would relieve. One strategy can have multiple functions associated with it.

For example, the strategy "Develop a Digital Communications Interface for use by OCs" from the A3RM study supports these functions:

- Contact TAAF-X analyst and request OC AAR aid Requirements,
- Receive and clarify exact AAR aid requirements from OC,

- Transmit AAR aids that need correction to TAAF-X analysts and clarify actual corrections required,
- Receive final AAR aid from TAAF-X and forward to OC, and
- Receive completed AAR aid products and forward to OC for review.

Through the use of artificial intelligence (AI), the computer systems that monitor the TES/IS data stream during force-on-force engagements can be set up to do specific actions based on events. An example would be chemical and biological strikes used during engagements. The computer can monitor the data stream. When it detects a chemical or biological mission being fired it can automatically produce items to support the AAR. An example might be that when a chemical or biological mission is fired the computer automatically constructs a top down view AAR aid of the affected units in the chemical hazard area. This strategy would automatically locate the biological strike in the exercise area through AI, which would eliminate the need for the TAF analyst to do that function. The strategy satisfies the function. This allows the full function score to be used as an indication of the value of the workload function (see top of Figure 15).

In this next example, the strategy only assists in satisfying the function since it will not completely eliminate the TAAF-X analysts' requirement to title the AAR aid. Given the above example, the AAR aid would be automatically show a top down view of units in the chemical/biological hazard. However, the TAF analyst would still be required to provide a title for the aid. For this reason, a value of half of the total function score is used as an indication of value of the workload function (see bottom of Figure 15).

TAAF-X Concept Strategies and Functions Pairing Edit/Entry Form

Strategy Automate event-triggered actions on standard format. ▼

Function Assist/ Satisfied by Strategy Locate biological strike in exercise history. ▼

Select One

Does the Strategy Assist in Satisfying the Function ?	<input type="checkbox"/>
Does the Strategy Completely Satisfy the Function ?	<input checked="" type="checkbox"/>

Function Score	Workload
44	44

TAAF-X Concept Strategies and Functions Pairing Edit/Entry Form

Strategy Automate event-triggered actions on standard format. ▼

Function Assist/ Satisfied by Strategy Title the AAR aid as directed by the CTC TAF analyst. ▼

Select One

Does the Strategy Assist in Satisfying the Function ?	<input checked="" type="checkbox"/>
Does the Strategy Completely Satisfy the Function ?	<input type="checkbox"/>

Function Score	Workload
34	17

Figure 15. Database screen displays illustrating two different states of function satisfaction for the same strategy.

Objectives and Strategies

In order to allow the user to assess his coverage of TAAF-X objectives, objectives must be paired with strategies. We have already performed this pairing; however, the user may change the pairings as desired. Each strategy may address more than one objective.

Strategies and Problems

The last pairing we created was that of strategies and problems. We took each problem and went down the list of strategies, associating them where appropriate. At this point, we found several problems that had no strategies listed in the database that would solve them. We developed strategies to solve many of these problems, but in some cases were unsuccessful in finding solutions that would have a direct impact on workload. We discussed these problems earlier in the section entitled "Problems addressed in the database."

Database Flexibility in Evaluating Strategies

Once we had created all of the associations, we realized we needed the capability to pick and choose problems and associated strategies to solve them. We also saw the need to be able to group these strategies under a name to allow us to wargame combinations of strategies and problems to get the maximum benefit. We call these groupings plans. The following examples show ways in which the decision-maker can formulate his plans.

Plan 1. Baseline. This plan includes all problems and solutions. We used this plan to show what is possible if all strategies are implemented.

Plan 2. Plan 2 looks at solving those problems with a score of 75 or above, regardless of strategy score. A score of 75 means the problem either is a homestation problem or a problem for both MCTCs and homestations and is either serious or critical. NOTE: Problem scores consist of a combination of scores related to problem impact (MCTC problem (5), homestation problem (10), Both (15)) multiplied by the problem urgency score (Critical (10), Serious (5), or Annoyance (1)).

Plan 3. This plan looks at focusing on strategy scores, regardless of the problem or problem score. Plan 3 selects all strategies with scores of 500 or better. NOTE: These scores are the sum of the workload scores assigned to the functions associated with the strategy. The higher the workload score, the more effort required to complete the function, consequently, the more valuable to satisfy.

Plan 4. Plan 4 focuses on specific strategies listed below. In this plan, we focused on using strategies assisting the TAAF-X analyst in his duties, regardless of problem, problem scores, or strategy scores:

- Automate and streamline production of AAR products through the use of AAR product sets database
- Automate event-triggered actions on standard format
- Automate statistical AAR products
- Automate the production of OC discussion outlines which address the significance of each AAR product

- Create a Performance Timeline
- Create homestation/TAAF-X analyst video teleconference and whiteboard capability
- Provide TAF analysts the ability to employ voice-to-text technology
- Integrate IS information (ground truth) with command, control, communications, computers and intelligence digital information (perceived truth) on the AAR workstation
- Limit the number of AAR product types available for use
- Receive and display digital messages from Army Tactical Command and Control System and Force XXI Battle Command Brigade and Below
- The TAF workstation should support analyst queries for information and generate reports
- Time-tag voice communications at the TAAF-X workstation

Results from Each Plan

The following definitions pertain to the plan results:

Weighted Function Score: The sum of the function scores after the test of whether or not the strategy completely satisfies the function or partially satisfies the function.

Overall Plan Effectiveness Score: This score is the quotient of the plan's weighted function scores divided by the sum of all function scores, then multiplied by 100.

Workload Percentages: The weighted function score total for the particular problem category (Critical, Serious or Annoyance) divided by the sum of all function scores within the problem category, then multiplied by 100.

Overall Implementation Effects for **PLAN 1 Baseline** (see Appendix E)

Overall Plan Effectiveness Score **68.98** *out of a possible 100.*

Overall Plan Function Score

Plan Includes **123** of **138** Trainer Functions.

Plan Supports **5** of **5** TAAF-X Objectives.

Plan Addresses **2** of **2** CRITICAL problems and **63.18%** of the workload.

Plan Addresses **4** of **4** Serious problems and **63.90%** of the workload.

Plan Addresses **5** of **5** Annoyance problems and **67.24%** of the workload.

Overall Implementation Effects for **PLAN 2 Problem Scores \geq 75**
(see Appendix E)

Overall Plan Effectiveness Score **29.03** out of a possible 100.

Plan Includes **54** of **138** Trainer Functions.

Plan Supports **5** of **5** TAAF-X Objectives.

Plan Addresses **2** of **2** CRITICAL problems and **63.18%** of the workload.

Plan Addresses **3** of **4** Serious problems and **62.84%** of the workload.

Plan Addresses **0** of **5** Annoyance problems and **00.00%** of the workload.

Overall Implementation Effects for **PLAN 3 Problem Scores \geq 500**
(see Appendix E)

Overall Plan Effectiveness Score **40.81** out of a possible 100.

Plan Includes **76** of **138** Trainer Functions.

Plan Supports **5** of **5** TAAF-X Objectives.

Plan Addresses **2** of **2** CRITICAL problems and **50.19%** of the workload.

Plan Addresses 3 of 4 Serious problems and 56.91% of the workload.

Plan Addresses 3 of 5 Annoyance problems and 40.46% of the workload.

Overall Implementation Effects for **PLAN 4 Strategies with impact on TAAF-X analyst workload** (see Appendix E)

Overall Plan Effectiveness Score 27.37 out of a possible 100.

Plan Includes 51 of 138 Trainer Functions.

Plan Supports 5 of 5 TAAF-X Objectives.

Plan Addresses 2 of 2 CRITICAL problems and 59.56% of the workload.

Plan Addresses 4 of 4 Serious problems and 59.90% of the workload.

Plan Addresses 5 of 5 Annoyance problems and 26.99% of the workload.

Assuming the baseline is not possible, Plan 3 is the best plan. This is the best if you are looking at the overall plan score or the number of total functions addressed. If your emphasis is attacking critical problems, the best is Plan 2. Plan 2 is also best if you are trying to mitigate both critical and serious problems. If you wanted to mitigate some of each problem, Plan 4 would be the correct plan. Obviously, there is no "approved solution". The decision-maker must have a goal in mind, then wargame the strategies and problems to determine the plan that will satisfy his goal.

Feasibility of Implementing the TAAF-X Concept

We believe the TAAF-X concept is feasible assuming the following implementation prerequisites are realized:

1. The concept depends on reliable communications links between each training site and TAAF-X. Currently, when the communications system fails at NTC, maintenance crews are able to troubleshoot and repair it without disrupting exercise play. This capability is due in part to the technical knowledge the personnel at NTC have on the system and in part on the fact that the fault is confined to the installation (Advancia, 1999b). With TAAF-X the fault is not confined to an installation. For example, if TAAF-X, located in Kansas, is supporting an exercise in Texas, then the fault can occur at any point in between the two locations. If a telephone pole that just happens to be carrying the signal for the exercise TES/IS data is severed in Enid, Oklahoma, how long will it take to repair it? Who will know what caused the outage and where? Who will repair it? What happens to the exercise? Who makes the decision on the exercise?
2. The concept depends on automation objectives being achieved as projected in this study. Assuming automation objectives are met, then critical workload can be reduced by over half (see Plan 4). Currently, we have found that a typical TAF analyst at NTC services six OCs in the field (Operations Group, NTC, 1999). If the TAAF-X analyst is charged with servicing two TAF analysts who, in turn, service six OCs each, there is a great potential for the TAAF-X analyst to become overwhelmed during the exercise.
3. The concept depends on a common instrumentation system for all MCTCs. Each of the MCTCs uses different IS (Advancia, 1999a, 1999b). Implementing TAAF-X in this environment may result in lost flexibility. For example, if TAAF-X consists of five cells, one cell must be configured for NTC, one cell for JRTC, one cell for CMTC, and the other two for homestation installations. The NTC cell must always support NTC. Even if there are no exercises occurring at NTC, the cell cannot be used for any other MCTC or homestation installation due to its special configuration. This same restriction would apply to all MCTC cells. Additionally, the homestation installation cells can only be used for homestation installations, since each MCTC has its own a special configuration.

Conclusions and Recommendations

Certain of the proposed solutions for addressing potential TAAF-X implementation problems influence the benefits offered by a TAAF-X. If we provide software for automated AAR aid generation at each training site, we miss the reductions in software costs made possible by having only one site for AAR aid generation. Similarly, the lack of TAAF-X control over when training sites are scheduled to use TAAF-X analysts, makes it hard to guarantee that the time of analysts will be employed in an efficient manner.

The remaining benefits of TAAF-X are not influenced by solutions to implementation problems. These benefits are:

- help insure that high quality AAR products will be available at each site
- link MCTC and homestation training
- help to manage requirements for future AAR system upgrades

Gaining the benefits described above does not require that TAAF-X prepare AAR aids for each site. Instead, TAAF-X analysts may provide guidance on AAR aid preparation before, during, and after exercises. Such assistance is likely to be crucial in situations where personnel at homestation training sites are tasked to serve as analysts on a short-term basis. Under this version of the TAAF-X concept, it may be easier for TAAF-X analysts to support multiple exercises at the same time.

The problem of staffing analyst positions may be addressed in part through automation of the AAR preparation process. This approach may reduce greatly the number of analysts needed to support the training of a unit. The production of the part of an AAR aid illustrating what happened during an exercise can be automated to the point where the only input required by analysts is the identification of the time when selected tactical events occurred. The work required of the analyst to finish these aids depends upon what the OC requests. The OC may want to zoom or pan the display, add or change the title, add questions, add comments, or add line drawings. To the extent that the system supports this AAR tailoring capability, the analyst's workload can be reduced further. The work required to prepare AAR aids containing "how to fight" guidance can be reduced to having the analyst select from a menu of previously prepared AAR aids, based upon what the OC wants. OCs and analysts at the MCTCs have already done a great job of "automating" the preparation of

this type of aid to the point where OCs can request AAR aids by an identifying number.

An important concern in the homestation environment, with its less experienced OCs and analysts, is how OCs will know what AAR aids to request. The state of automated AAR aid generation is such that a number of candidate AAR aids will be available that reflect what actually happened during an exercise; however, OCs will have to select among these candidate aids and decide how to orchestrate the use of aids in a way that will help the unit decide what happened, why it happened, and how to improve future performance. Again, an experienced TAAF-X analyst can serve as a source of advice.

It is reasonable to assume that substantial experience is required for trainers to learn what types of AAR aids and tailored features work best for different types of unit performance problems at various echelons. The only trainers likely to gain this level of experience are those individuals serving as a member of training cadre for extended periods. We can capture some of this experience and incorporate it into AAR software for use by all, but much of this experience is probably best shared on a person to person basis.

We need empirical data regarding the impacts of automating the AAR aid production process on analyst workloads and analyst training needs. This information is relevant to deciding if, and how, to implement a TAAF-X, as well as being relevant to Homestation Training Instrumentation and MCTC-OIS. The Program Manager for Combined Arms Tactical Trainer has recently initiated an AAR improvement effort for the Close Combat Tactical Trainer (CCTT) that includes automating the AAR aid preparation process through battalion task force level. Current plans call for demonstration software to be available in January of 2001, providing an opportunity to collect data on the impacts of an operational automated AAR system on workloads and user training needs.

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Appendix A - List of Abbreviations and Acronyms

A3RM	Advanced After Action Review Media
AAR	After Action Review
AI	Artificial Intelligence
ARI	Army Research Institute
ATESC	Advanced Tactical Engagement Simulation Concepts
ATSC	Army Training Support Center
ATMD	Army Training Modernization Directorate
BCT	Brigade Combat Team
BDA	Battle Damage Assessment
BLUFOR	Friendly Forces
BN/TF	Battalion Task Force
CAF	Control and Feedback
CALL	Center of Army Lessons Learned
CCTT	Close Combat Tactical Trainer
CMTC	Combat Maneuver Training Center
CO/TM	Company Team
CRIOT	Cognitive Requirements for Information Operations Training
CTC	Combat Training Center
CTC-OIS	Combat Training Center - Objective Instrumentation System
CVKI	Combat Vehicle Kill Indicator
DA	Department of the Army
DCI	Digital Communications Interface
DIFCUE	Direct/Indirect-fire Cue
EMCC	Exercise Management and Control Cell
FM	Field Manual
HITS	Homestation Instrumentation Training System
IS	Instrumentation System
JRTC	Joint Readiness Training Center
MCTC	Maneuver Combat Training Center
MEL	Mission Events List
METL	Mission Essential Task List
MILES	Multiple Integrated Laser Engagement System
NTC	National Training Center
OC	Observer/Controller
OCCS	Observer/Controller Communications System
OIS	Objective Instrumentation System
OPFOR	Opposing Forces
OPTEMPO	Operational Tempo
PLT	Platoon
RSTA	Reconnaissance, Surveillance and Target Acquisition
STRICOM	Simulation, Training and Instrumentation Command

TAAF Aids	Training Analysis and Feedback Aids
TAF	Training Analysis Facility
TAAF-X	Training Analysis and Feedback Center of Excellence
TES	Tactical Engagement Simulation
THP	Take Home Package
TRADOC	US Army Training and Doctrine Command
TTP	Tactics, Techniques and Procedures
VISMOD	Visually Modified

Appendix B - Combat Training Center Current Operations

Maneuver Combat Training Center Personnel

The OC is a tactically and technically competent officer or non-commissioned officer who serves as trainer, observer and exercise controller. He monitors safety, enforces rules of engagement, assesses casualties and battle damage, observes critical tactical events, performs one-on-one coaching, conducts AARs, and submits input to the training unit's take home package (THP). OCs at the Army's maneuver Combat Training Centers (MCTCs) perform OC duties on a full-time basis. Occasionally, personnel from tactical units, TRADOC schools and Reserve Component advisors perform OC duties to augment MCTC OCs. Regardless of whether the OCs are assigned to the MCTC or are augmentees, they must attend and successfully complete the OC Academy at the MCTC before performing their duties in a rotation.

The Training Analysis Facility (TAF) analysts observe and analyze unit performance using computer workstations. These workstations support analysts by providing them with top-down views of the exercise, video, and player tactical voice and digital communications. The TAF analysts at the MCTCs are civilians, officers, and non-commissioned officers. TAF analysts work specifically with a designated counterpart OCs (up to 6 different OCs at various echelons). Working as a team, the OCs and TAF analyst control the exercise, exchange observations on player activity, and identify potential causes and effects of tactical outcomes. Before, during and after the exercise the TAF analyst prepares AAR products to support the OCs' AAR presentation. The analyst also integrates OC input and produces the THP for the training/rotating unit.

Training Analyst Facility (TAF) Structure

The TAF structure varies between MCTCs and is configured to maximize support to BLUFOR units based on requirements of the installation. There is no standard TAF structure among the MCTCs. Despite the differences among the MCTCs, their operations are similar in that they are divided into TAF cells at each installation. These cells have military and civilian analysts who support OCs in their interactions and duties with the BLUFOR units. During the visit to the National Training Center (NTC), TAF operations and structure made up a large part

of the discussion with TAF analysts. This appendix will address the TAF structure at NTC to provide insight into how TAF analysts provide support to their OC team and other analysts during normal BLUFOR rotations. In Figure B-1 we see the current TAF teams represented in the NTC TAF.

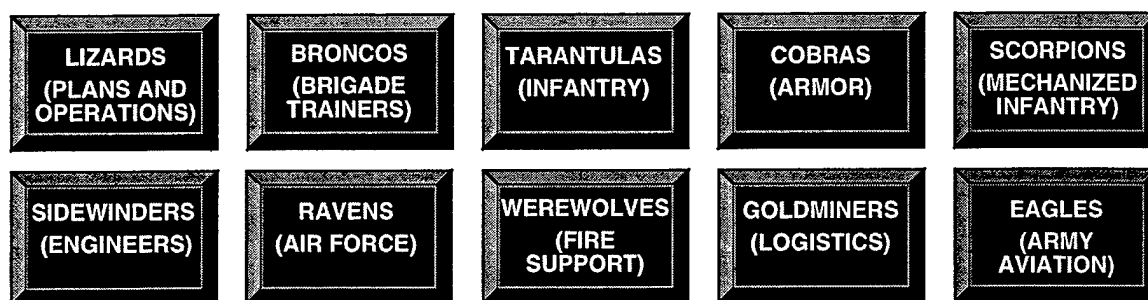


Figure B-1. NTC TAF team organizations.

Each TAF cell consists of military and civilian TAF analysts. Within each TAF cell there are approximately 10-12 military and civilian personnel. These personnel monitor the workstations depict the positions of instrumented BLUFOR player elements on the battlefield. The TAF analysts using these workstations can manipulate the data displayed and combine it with data from other sources (video and audio transmissions) to produce AAR products to support OCs during their AAR presentations. The civilian TAF analysts stated that by company policy they are not authorized to work over 13 hours in a shift. The civilian TAF analysts at NTC attempt to use "surge operations" to cover critical times during the battles where the most personnel are needed. This solution is becoming less viable. The civilian analysts stated that due to unit training problems, a movement to contact that used to take 4 hours from start to finish, now lasts 6-8 hours. Because of the long battles, AAR products are being constructed at times that "overlap" the normal times that shifts change. This usually causes the outgoing shift to spend additional time "briefing up" the oncoming shift before leaving. Although many civilian TAF analysts knew their actual shift was 12 hours, they stated it was often not practical to leave during the making of AAR products. At the Joint Readiness Training Center (JRTC), the civilian TAF analysts also use "surge operations" to support training. At JRTC, the civilian analysts work two weeks straight using normal shifts to support the engagements, then are off for two weeks.

A TAF analyst who supports OCs typically supports five or six OCs with BLUFOR rotational units at various echelons during a battle. The Operations Group at NTC has overall responsibility for all OC Teams TAF cells. Figure B-2 lists player unit positions supported with an OC during normal unit rotations.

<p><u>BATTALION (BN) LEVEL COVERAGE:</u></p> <ul style="list-style-type: none"> • BN Commander • BN Executive Officer (XO) • BN Operations Officer • BN Fire Support Officer • BN Engineer Officer • BN Air Defense Officer • BN Supply Officer • BN Personnel Officer • BN Maintenance Officer • BN Chemical Officer • BN Signal Officer 	<p><u>COMPANY LEVEL COVERAGE:</u></p> <ul style="list-style-type: none"> • All 5 Company Commanders • All 5 Company Executive Officers / First Sergeants • All 12 "LINE" Platoon Leaders <p><u>BN SPECIALTY PLATOONS:</u></p> <ul style="list-style-type: none"> • BN Mortar Platoon Leader • BN Scout Platoon Leader • All 3 Scout Section Leaders • BN Medical Platoon Leader • BN Support Platoon Leader
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Figure B-2. - OC Assignment Locations for Normal NTC Rotations (Operations Group, 1999).

NTC TAF analysts told us that the Senior OC BN/TF level AAR receives the most automated support. The TAF analysts stated that they sometimes develop AAR products for CO/TM OCs and rarely develop them for PLT level OCs. Lack of time was the reason TAF analysts and OCs cannot consistently provide CO/TMs and PLTs with AAR products. The presentation of CO/TM level AARs occurs at NTC at end of mission (EOM) plus 2 hours. The presentation of PLT level AARs occurs at EOM plus 1 hour. This quick time between end of mission and AAR presentation makes it difficult to support these OCs with AAR products. The TAF analysts support the OCs at CO/TM and PLT level with AAR products, but the OCs must travel from the field to the TAF location to pick-up the AAR products. This distribution system often is not practical. Further, many of the products used in CO/TM and PLT level AARs are manually created, thus precluding electronic transmission. The BN/TF level AAR occurs at EOM plus six hours. The TAF has the most time available to prepare BN/TF

AAR products for presentation. Despite the added time available for the BN/TF level AAR, it is often difficult to prepare AAR products requested late in the battle and have them ready before presentation.

In the TAF cells, the military analyst (commonly called the 07T) works with the civilian analyst in producing AAR products. The relationship between the military and civilian analyst is critical to the smooth function of the TAF and support of the OCs in producing AAR products. The 07T monitors the battle on the TAF workstations much as the civilian analyst does; however, his primary focus is information flow between the OCs and the TAF. The 07T has the primary mission of keeping the Senior OC (commonly called the 07) current on all operations. Additionally, the 07T assists other analysts from different TAF cells if they request information in support of their AAR products. The 07T's first priority is to the Senior OC and the OCs he supports. He assists other analysts as required. The 07T receives requests from the OCs, the Senior OC, and other TAF cells, and he must constantly monitor the radio to receive these requests. When a request for an AAR product is received, the 07T coordinates with the OC to determine exactly how the OC wants the AAR product to look. The 07T then coordinates with the civilian analyst who begins to construct the AAR product, freeing the 07T to return to monitoring the battle. While the civilian analyst is working on the AAR product, the 07T monitors the TAF analyst workstation and the radio to process requests for AAR support until the civilian analyst returns. When the civilian analyst returns, the 07T updates the analyst on what happened in the battle. The process of receiving AAR product requests, consulting with the civilian analyst for specific AAR requirements, and the civilian analyst constructing the AAR product continues throughout the rotation, as required. In addition to normal requests for AAR products, the 07T also receives specific guidance on AAR product requirements from the Senior OC.

The Senior OC (the 07) directs the TAF analysts on critical events that he wants captured as AAR products for each engagement. The TAF analysts refer to this direction as the Senior OC's focus for the engagement. An example of a critical event could be BLUFOR actions during a breaching operation. In this case, the 07T would construct an AAR product at the time of the breach to the Senior OC's specifications. Any time during the battle when specific actions occur, the Senior OC may also specify AAR products that he wants captured such as a fratricide incident to use during the AAR. The Senior OC may change the

focus of the engagement at any time to ensure the TAF is gathering the proper information to reflect the strengths or weaknesses seen in the BLUFOR unit operations. This Senior OC direction assists the TAF analysts in setting priorities for observing the engagements and supports the Senior OC in providing AAR products for the BN/TF level AAR. The Senior OC conducts the BN/TF level AAR. The TAF analyst stores AAR products in a designated Aid Bin. Other OCs or TAF cells may use these products to support their AARs.

Weapon Simulation and Exercise Control

The Tactical Engagement Simulation (TES) system simulates the employment of a weapon system during force-on-force training between the rotating/training unit (BLUFOR) and a live opposing force (OPFOR). For example, to simulate direct-fire engagements, weapons are equipped with a TES system called the Multiple Integrated Laser Engagement System (MILES). MILES emits an eye-safe laser when the soldier fires the weapon. MILES sensors on soldiers and equipment detect engagement by the laser and produce an audio and/or visual cue for a kill, hit or near miss. For indirect-fire and area weapons, the Simulated Area Weapons Effects (SAWE) system simulates artillery, mortars, chemical attacks and minefields. SAWE compares the location of exercise players with the area affected by the ordnance and electronically assesses casualties and battle damage.

The Instrumentation System (IS) is an electronic data collector that monitors position location, the TES devices on soldiers and vehicles, and captures exercise player activity. The IS feeds the TAF with data that the TAF workstations convert into computer-generated graphics, providing a top-down view of player location, status (alive or dead), movement, firing activity, etc. The IS also records BLUFOR tactical voice communications, supports OC and TAF control communications, and displays video from mobile video crews in the exercise area.

When the TES system fails to provide adequate simulation of engagements, OCs and TAF analysts perform exercise control actions to provide player personnel with realistic simulations. Figure B-3 below illustrates control procedures necessary to provide simulation feedback to exercise players for an artillery fire mission. (Brown et al., 1999b).

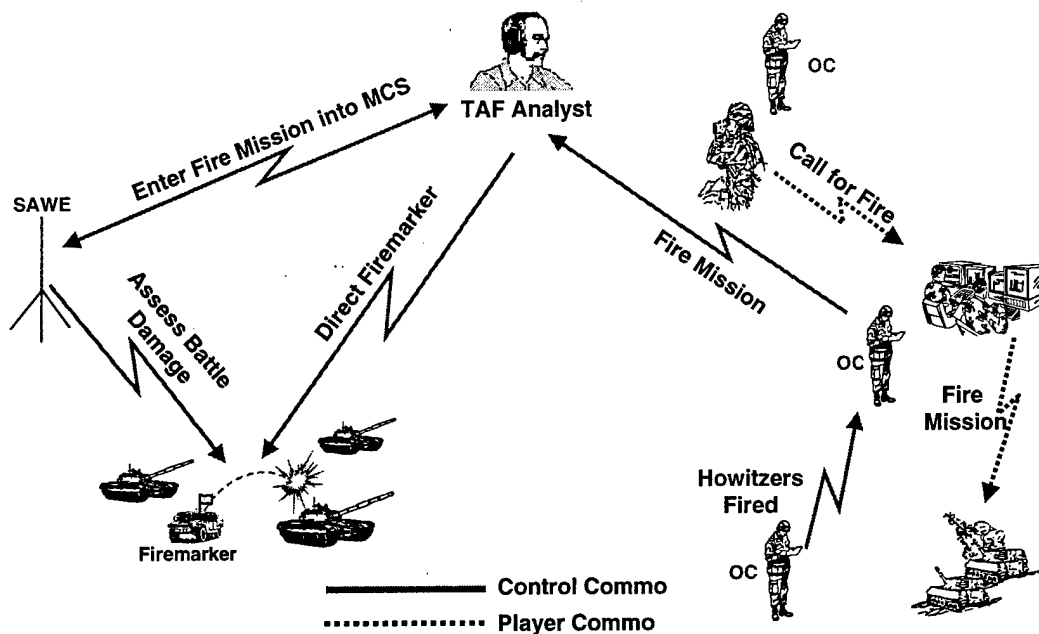


Figure B-3. Example of exercise control.

To produce the appropriate battlefield effects and battle damage/casualty assessments for indirect-fires, trainers must perform extensive control actions:

1. The OC collocated with the forward observer (FO) monitors the FO's call for fire.
2. The OC, collocated with the howitzer platoon fire direction center (FDC), observes the FDC's procedures in determining fire mission data. The FDC OC also passes the target location, projectile type, number of projectiles fired, and firing unit(s) to the TAF analyst for entry into the TES system--SAWE.
3. A firing platoon OC observes the actions of the howitzer platoon in laying the howitzers and preparing ammunition for the fire mission. The firing platoon OC notifies the FDC OC of whether or not the firing platoon performed all procedures correctly.
4. The FDC OC directs the TAF analyst to fire the mission in SAWE after receiving notification from the firing platoon OC that the howitzers have fired. If there are any errors by the FDC or the howitzer platoon, the FDC OC informs the TAF and the TAF analyst adjusts the point of impact for the fire mission accordingly.

5. The TAF analyst executes the mission in the SAWE control station. SAWE assesses casualties and battle damage for the fire mission and generates an indirect-fire vector on the analyst's top-down view of the exercise. Concurrently, a second analyst notifies a Firemarker to mark the location of the impacting ordnance to provide the visual and aural effects to players in the target area. At JRTC, SAWE activates a Personal Detection Device (PDD) when the wearer is within the indirect fire weapons effects radius. Because of the weight (18 pounds) and safety concerns with its batteries, only the OCs wear the PDD. The PDD allows the IS to track the OC position and is activated by SAWE. When the PDD activates, the OC contacts the TAF analyst to determine what caused the activation. The TAF analyst informs the OC that his location has received effects from an artillery mission. The TAF analyst gives the OC the grid location, number and type artillery rounds fired and the OC makes an assessment based on Artillery Effects tables. When the OC has determined the proper battle damage to assess, he uses his control gun to "kill" the correct number of vehicles or dismounted soldiers affected by activating their MILES. The OC then reports his actions and BDA to the TAF analyst. NOTE: Fielding of the Direct/Indirect-fire Cue (DIFCUE) will provide aural and visual cues for indirect-fires impacting in the vicinity of mounted forces. The DIFCUE, which will be mounted on tactical vehicles, will set-off pyrotechnics when signaled by SAWE. The DIFCUE will begin fielding in FY99 (Brown et al., 1999b). Indirect-fires simulation against dismounted soldiers will require continued use of firemarkers that use artillery simulators to simulate impacting ground or air-bursting ordnance.

OC and TAF Analyst Exercise Control Functions

As described in the above exercise, control involves functions performed by the OC or TAF analysts to provide players adequate feedback for simulations. Shortcomings of the TES/IS at the MCTCs require these functions for current and emerging systems. The Advanced Tactical Engagement Systems Concepts (ATESC) Study identified 228 specific functions required to provide adequate simulation feedback for current and emerging weapon systems (Brown et al., 1999b).

The OC and TAF Analyst, using information gathered from observations of the unit and TES/IS data, consolidate their

comments into the AAR. The AAR is a dynamic discussion among the BLUFOR exercise players in which the key leadership of the unit seeks to determine--what happened, why it happened and how to improve performance. An AAR facilitator/leader, trainer or OC guides BLUFOR players in their discussions. We refer to the AAR facilitator/leader as the OC. The OC, through the use of various multimedia displays or AAR aids, guides player discussions to establish the causes and effects that led to the tactical outcome. These AAR aids present the tactical mission, task standards and an indisputable version of "ground truth" of BLUFOR's performance.

AAR aids display the unit's plan (what was supposed to happen), identify what happened during mission execution and stimulate player discussions on why it happened. During these discussions, BLUFOR players learn from their mistakes and benefit from the lessons learned by other players. The AAR becomes the bridge between the completed training event and the next training event, providing exercise participants with post-exercise learning on how to improve performance and fix training weaknesses.

OC/TAF Analysts Interactions for AAR Production

TAF analysts, in coordination with their OC counterparts, prepare AAR aids for the BN/TF, subordinate units, staff and support slice (i.e., field artillery battalion, forward support battalion, engineer company) AARs. The preparation of AAR aids is extremely labor intensive. TAF analysts and OCs conduct AAR preparations before, during and after mission execution. Figure B-4 depicts the vertical and horizontal coordination among OCs and TAF analysts for AAR preparations (Brown et al., 1998).

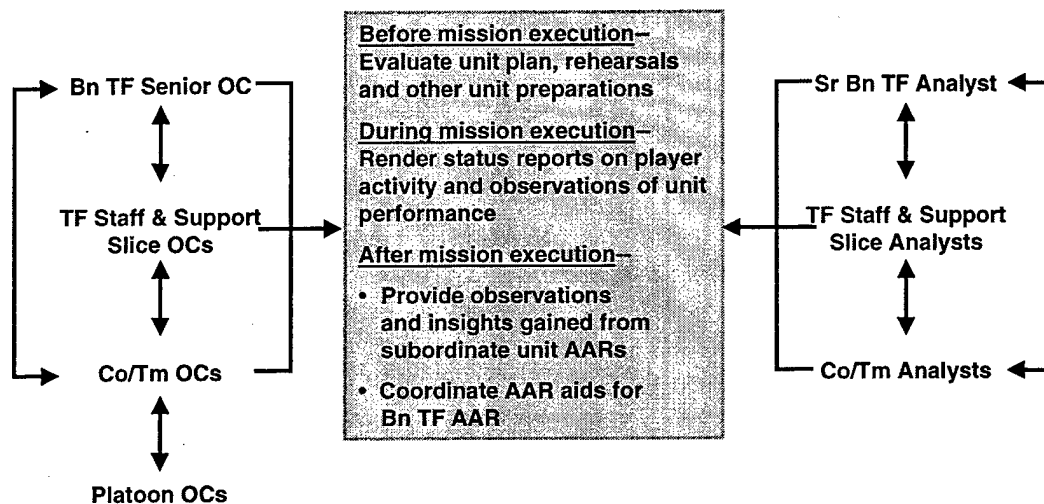
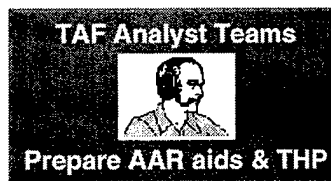


Figure B-4. OC and TAF teamwork.

OCs perform direct observations of human behavior, such as the interaction among commanders and staff officers during the decision making process. To maximize BLUFOR training benefits, OCs take advantage of opportunities to coach and mentor their player counterparts during mission planning and preparation, as well as during exercise pauses. The OC may coach a player counterpart who is stumbling during the preparation of a staff estimate, or in planning a mission rehearsal. OCs also perform risk assessments regularly, and cross-check their assessments with their player counterparts, proactively identifying safety issues and recommending measures to reduce risk.

OCs and TAF analysts manually collect a considerable amount of data during the training unit's planning and preparation for the upcoming operation. OCs observe BLUFOR's decision-making process, OPORD preparation and record behavioral observations. Thereafter, OCs observe BLUFOR confirmation briefs, briefbacks and mission rehearsals, while TAF maneuver analysts manually enter the unit's overlays into the TAF workstation. Concurrently, TAF fire support analysts enter BLUFOR and OPFOR pre-planned artillery and mortar targets into their workstations. Additionally, they position firemarkers and smoke generators in the exercise area based on the BLUFOR fire support plan. Senior OCs prepare a control and observation plan to

determine where to position OCs during the battle to preclude unobserved/uncontrolled events and to reduce the chances that OC activity will compromise BLUFOR and OPFOR dispositions.

Before mission execution, OCs and TAF personnel analyze, record and exchange observations on BLUFOR planning and unit preparations. Thereafter, TAF analysts prepare AAR aids on significant findings. For example, a fire support analyst and an intelligence analyst may compare known, suspected and likely enemy positions appearing in the OPORD's intelligence annex with planned targets in the fire support annex. If they find discrepancies, the fire support analyst will prepare an AAR aid showing disconnects in planned targeting.

For the planning and preparation phase of the exercise, the IS provides little data to support AAR preparations. TAF analysts and OCs manually collect and enter the data needed to depict and assess BLUFOR planning and preparations for the upcoming operation (i.e., the Bn staff's support of the decision making process, OPORDs, overlays, target lists, mission rehearsal observations). Currently, the TAF analyst must manually plot each control measure from the various tactical overlays into the TAF workstation to view player maneuver and firing activity in relation to the BLUFOR plan.

The Cognitive Requirements for Information Operations Training (Brown et al., 1999a) determined that the manual entry of command and control information into the TAF workstation is necessary even if the unit is digitized. Since the TAF workstation and tactical digital systems are not interoperable, the analyst cannot readily contrast the dynamics of BLUFOR situational awareness and IS ground-truth information on a common display. If an analyst wishes to show the incongruities between BLUFOR situational awareness on OPFOR dispositions and OPFOR's actual dispositions, he must prepare two AAR aids. First, he prepares a screen grab from the tactical digital system displaying BLUFOR's perception of OPFOR's dispositions. Next, he prepares a snapshot of OPFOR ground-truth dispositions using his TAF workstation. The analyst displays these AAR aids side by side during the AAR presentation so the training unit may compare these incongruities and assess the effects on the unit's mission planning, preparation and execution.

During the execution phase of the exercise, TAF analysts view animated, computer-generated graphics depicting player vehicle status, movement and firing activity superimposed over BLUFOR control measures. Using the Observer Controller Communications System (OCCS), TAF analysts and OCs exchange

observations on BLUFOR's performance. As his exercise control duties permit, the TAF analyst prepares AAR aids reflecting BLUFOR's performance during mission execution. The TAF analyst may prepare one or more AAR aids, using different media, to depict specific aspects of BLUFOR performance during a tactical event. For example, during a breaching operation, the OC may prepare the following aids:

- Audio clip of the scout platoon leader's voice transmission to the BN/TF commander (CDR) reporting the spotting of an OPFOR obstacle.
- Screen grab of the scout platoon leader's digital message graphically depicting the area affected by the OPFOR obstacle.
- Animated, top-down, computer-generated views depicting the effectiveness of BLUFOR's direct and indirect fires in suppressing OPFOR during BLUFOR breaching operations.
- Video clip showing the effectiveness of BLUFOR smoke in obscuring OPFOR's vision during BLUFOR's breaching and maneuver efforts to secure the far side of the obstacle.
- Screen grab of the breach force CDR's digital message graphically showing the lane breached through the OPFOR obstacle.
- Statistical shooter/victim table to summarize the results and outcome of the breaching operation.

To prepare a top-down, ground-truth, still or animated view of player activities during near-real-time observations of the exercise, the analyst performs the following seven procedures using the TAF workstation:

1. Time-tags the activity in near-real time or locates the event in exercise history.
2. Pans the map to bring the tactical event into view, i.e., a chemical strike, assault, indirect-fire engagement, breaching operation, sensor detection.
3. Selects the scale and zoom level that best portrays player activities.

4. Selects the appropriate BLUFOR or OPFOR control measures for display.
5. Selects other on/off display options to enhance the impact of the AAR product such as the display of range fans, search sectors, ordnance footprints, indirect-fire vectors, player IDs, grid lines and contour intervals.
6. Annotates the significance of the view in a log or on the display itself, i.e., "Distance between Team A and Team B precludes mutual support."
7. Stores the views in an AAR aid bin for later review.

As the TAF analyst monitors the exercise, he listens to BLUFOR tactical voice communications at his workstation. The TAF analyst either electronically time-tags player tactical voice communications that he wishes to play back during the AAR, or he records the time and nature of the transmission in a paper-based exercise log. The analyst later prepares and stores a clip of the voice communications using his own workstation, or coordinates with a separate audio-video section to obtain the audio clip. Concurrently, other analysts monitor BLUFOR digital communications and prepare screen grabs of significant digital command and control actions and situational awareness information. Each tactical digital system in the TAF requires dedicated manning, and each digital system can monitor only one BLUFOR player/node.

During the exercise, the TAF analyst monitors video input from static and mobile video sources on one or more TV monitors. His workstation provides information on the location, orientation and TV channel for each video camera. The TAF analyst selects the video he wishes to view by selecting the appropriate channel on the TV. As the analyst views significant BLUFOR or OPFOR activities during the exercise, he informs his OC counterpart and records the time, channel and nature of the video segment electronically or in a paper-based exercise log. During a lull in the exercise or upon declaration of change of mission, the analyst coordinates with audio-video personnel to obtain the video clip for the AAR.

The NTC TAF workstation automatically generates dynamic statistics using data provided by the IS and algorithms embedded in the workstation's software. Examples of dynamic statistical

products are BLUFOR to OPFOR force ratio, mean kills-to-firings ratio, mean kill range for selected weapon systems, and average communications duration. The analyst must exercise caution in using dynamic statistics for the AAR. The TAF workstation derives dynamic statistics from IS data only. IS data consistently contains far less than 100 percent (approx.30%) of the shooter-to-victim pairings. The IS data does not account for the movement, firing activities and status of uninstrumented entities such as dismounted soldiers, vehicles reported as "position location lost" by the IS and vehicles with inoperable instrumentation devices.

During the execution phase of the exercise, the TAF analyst prepares AAR products using data provided by the IS, collected by OCs/TAF analysts and extracted from tactical digital systems installed in the TAF. The IS provides considerable data to support the preparation of AAR products. However, the ATESC Study revealed that there is a vast amount of manual data collection performed by OCs and TAF analysts. Additionally, the CRIOT Study revealed that battlefield digitization dramatically increases the TAF's workload (Brown et al., 1999a).

Since shooter-to-victim pairings by the instrumentation system are unreliable, the OCs go to each disabled BLUFOR vehicle and record the kill code of the OPFOR system that killed the BLUFOR vehicle. The kill code provides the type of weapon system (i.e., T80 Tank-main gun) for the shooter, but does not provide the shooter-player ID. Similarly, OPFOR units collect the kill codes from disabled OPFOR vehicles to identify the BLUFOR weapon system type that killed each OPFOR vehicle. OCs roll-up this information into killer/victim scoreboards that show the number and type of OPFOR weapon systems killed by BLUFOR weapon systems and vice versa. For example, the BLUFOR scoreboard might depict that M1A2 tanks killed eight T80 tanks, 15 BMPs and three BRDMs during the exercise.

The TAF analyst prepares various types of reports for the AAR. Some of these reports are mandatory AAR products and others are optional reports related to specific tactical outcomes. The NTC TAF workstation supports the construction of four types of reports--dynamic statistics (discussed earlier), configured reports, preformatted reports and free-format reports. Configured reports are linked to a database containing IS data or manually entered data. To generate a configured report, the analyst selects the type of report desired from a list of available reports and enters parameters for the report using drop-down menus. Then, the system accesses the database

to prepare the report. For example, the analyst may select a report entitled "Engagement Range by Target Type" then, through a series of drop-down menus, he enters the time frame, weapon type, target type and range interval to generate a tailored report. Preformatted reports are established templates in which the TAF analyst enters data manually into the report, i.e., demonstrated strengths and weaknesses. Free format reports are word slides in which the TAF analyst enters text, i.e., mission statement, task standards (Brown et al., 1999a).

The OC links his observations to important issues or teaching points and identifies the key issues that most affected the battle's outcome. Then the OC coordinates with his counterpart TAF analyst to create AAR products that display the key issues relative to exercise objectives and military doctrine. A designated OC coordinates essential issues with the OPFOR to ensure consistency in training feedback during the AAR.

During lulls in the exercise and the limited time available between change of mission and the AAR presentation, the analyst reviews all displays stored in the AAR aid bin. He titles each AAR aid to annotate the context and significance of the display. He consults an AAR aid cookbook to prepare mandatory displays for the AAR presentation. The OC also has a cookbook. Using OCCS, the TAF analyst and the OC discuss each aid prepared for the AAR and coordinate the need for additional displays, referring to specific formats in the AAR aid cookbook (Advancia, 1999a). For each AAR aid, the TAF analyst or OC formulates open-ended questions to pose to the AAR audience to facilitate performance assessment discussions. The TAF analyst also provides quotes from TTP references to support discussions on how to improve performance.

TAF analysts prepare AAR products for platoon, CO/TM, BN staff, support slice and BN/TF AARs. The primary focus for AAR preparations is on the BN/TF. After CO/TM, staff and support slice OCs complete their AARs, these subordinate OCs brief the BN/TF senior OC. The brief to the senior OC addresses:

1. Junior OC and TAF analyst observations and performance assessments.
2. Significant information that surfaced during subordinate unit, staff or support slice AARs.
3. AAR aids prepared by TAF analysts for the Bn TF AAR.

Two to three hours before the AAR, the senior BN/TF OC reviews each aid in an AAR van or theater. The senior OC selects the aids to be presented during the AAR, then conducts the AAR with the BLUFOR key leadership.

Today's AAR preparations are extremely labor intensive and require many highly trained OCs and TAF analysts who are unchallengeable in their tactical and technical competence. Additionally, TAF analysts must be highly skilled in the operation of a complex AAR system to prepare timely multimedia AAR products for BN/TF AARs, as well as company, staff and support slice AARs.

APPENDIX C - Current Homestation Training Operations

Currently, homestations do two basic types of training - external evaluation exercises and internal evaluation and skill enhancement/creation exercises. We will address both types.

Training Operations for Homestation Exercise Evaluations

The selection of observer controllers (OCs) at homestation locations is primarily based on experience of the soldier. The OC at homestation observes and comments on unit performance. The homestation OC monitors safety, enforces rules of engagement, assesses casualties and battle damage, observes critical tactical events, performs one-on-one coaching, and submits input to the training unit's evaluation/assessment report. The homestation evaluation/assessment report serves the same purpose as does the combat training center (CTC) take home package (THP). The evaluation/assessment report documents unit strengths and weaknesses based on OC observations and comments. The homestation OC may conduct after action reviews (AARs) for the supported unit, but in most instances, he provides comments to the formal AAR facilitator. The OC is available at the AAR to address specific comments to support the facilitator. OC training at the homestation installations may or may not include formal instruction on how to be a competent OC. At homestation, installation tactical units appoint personnel who are not participating in the exercise to perform OC duties for the training unit. The OC's level of training has a direct affect on comments and observations provided in the AAR. There is no consistency of OC training at homestations, and OC training expertise varies from highly trained to "Hey you, you're now an OC." This has a profound effect on the quality of observations in the homestation training environment. The homestation OC typically has a mission event list (MEL) to use in planning his observation activities. Frequently, the MEL has planned exercise events that are time or event driven. An example of a MEL event would be "Send a warning order to A Company at 1300 to conduct a hasty attack at 1700." In this example, the OC would want to be in position near A Company's tactical operations center, to see what the unit's reaction is to the event. Then the OC would continue to observe troop leading procedures within the company. This process would continue for each event on the MEL during the exercise.

At the homestations, there are no TAF analysts equipped with computer workstations to support the OC. The OC usually communicates with the OC Control Cell that manages OC actions during the exercise. The OC can call the control cell to verify that events on the MEL are still valid, and that the exercise events are continuing according to the MEL. The OC Control Cell is also where the OC receives logistics support as required for the exercise. Normally there is no specific control cell counterpart for each OC at the homestation. The size of the OC control cell varies with the unit and unit objectives.

Multiple Integrated Laser Engagement System (MILES) is the Tactical Engagement Simulation (TES) system at homestation installations used for direct fire engagements; and there is no automated TES for simulation of indirect fire engagements.

The MILES TES system is not capable of simulating non-line-of-sight (NLOS) engagements. Consequently, friendly forces (BLUFOR) and opposing forces (OPFOR) actions alone can neither trigger NLOS engagements nor adjudicate the results of such engagements. Figure D-1 provides an illustration of the complex control procedures necessary for the OC and OC Control Cell to provide simulation feedback to exercise players for NLOS engagements, in this case, an artillery fire mission (Brown et al., 1999b).

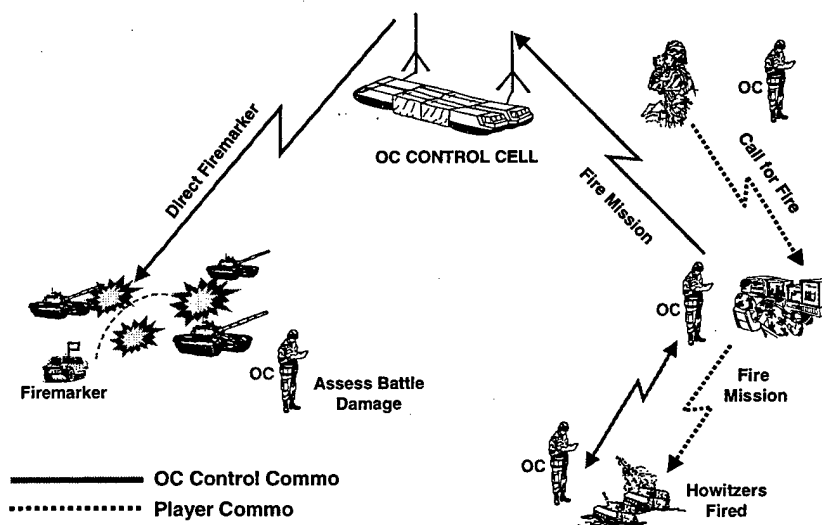


Figure D - 1. Homestation indirect fire exercise control

The OC and the OC Control Cell must perform extensive control actions to produce the appropriate battlefield effects

and battle damage/casualty assessments for indirect-fires at homestation:

1. The OC, collocated with the forward observer (FO), monitors the FO's call for fire. If there are any errors in FO procedures or the call for fire, the OC notes them for the FO and possible use in the AAR.
2. The OC, collocated with the howitzer platoon fire direction center (FDC), observes the FDC's procedures in determining fire mission data. The FDC OC monitors each fire mission and records the mission target location, projectile type, number of projectiles fired, and firing unit(s) and provides that information to the OC Control Cell.
3. A firing platoon OC observes the actions of the howitzer platoon in laying the howitzers and preparing ammunition for the fire mission. The firing platoon OC notifies the FDC OC as to whether or not the firing platoon performed all procedures correctly. If there are any procedural errors by the firing platoon, the OC notes them for comments to the firing platoon leader and possibly in the AAR.
4. The FDC OC directs the OC Control Cell to execute the mission after receiving notification from the firing platoon OC that the howitzers have fired. If there are any errors by the FDC or the howitzer platoon, the FDC OC notes the errors for possible discussion at the AAR.
5. The OC Control Cell assigns each fire mission a mission number and records who shot the mission, time mission fired, target location, target type, ammunition fired, number of rounds fired, and time mission completed for each mission fired. Each target location is posted to the map for all missions. Then the OC Control Cell contacts the closest firemarker to the mission's target location. There is no automated capability for assessment of battle damage and casualties at the homestations. The firemarker receives the mission number, target location, type ammunition fired, and amount of ammunition fired, then travels to the specific grid location. When the firemarker arrives at the fire mission grid location, he detonates artillery simulators to simulate the number of rounds fired. This also gives the player units an indication that indirect fire is landing at their location. After the firemarker detonates the simulators, he notifies the

nearest OC of the mission-fired information. The OC will assess battle damage based on an artillery effects table. The firemarker notifies the OC Control Cell that the mission has been successfully marked. When the OC has determined the proper battle damage, he uses his control gun to "kill" the correct number of vehicles or dismounted soldiers by activating their MILES. The OC then reports his actions and battle damage assessment to the OC Control Cell. The OC Control Cell records the results for AAR use, if desired. This process continues for each artillery mission fired.

Currently, there is no instrumentation system (IS) at homestation locations. This means there is no capability to electronically monitor player movement, firing activity, player location, or player status (alive or dead). The OC communicates unit information to the appropriate OC Control Cell counterpart using internal voice radio assets. The lack of an IS means that the homestation has no capability to generate automated AAR products.

Homestation training OC operations vary greatly between installations. The composition and size of the homestation OC support package depends primarily on the commander's objectives for the exercise. Frequently, the commander may not have all the OCs he needs to provide comprehensive feedback to player units. In those instances, the commander allocates OCs based on OC expertise and priority areas he wants assessed. OC duties at homestation vary, but typically they cover the following areas:

- Applicable Battlefield Functional Areas
- Staff: S1, S2, S3 and S4
- Maintenance Operations
- Company/Team (CO/TM) operations
- Platoon (PLT) operations
- OPFOR Control
-

A control element coordinates OCs activities to assist them in their duties. The OC Control Cell is supervised by a Senior OC and is organized in specific sections. For example, the Fire Support Section could be divided into cells that work with FO

OCs, FDC OCs and Battery Operations OCs. OCs would direct their observations to their associated OC sections. These sections assist the OCs by keeping them informed on the flow of the operation, unit positions, changes in planned events, updates in graphics and recording OC observations and discussions on events observed. The OC Control Cell also typically has a section that controls the firemarkers used to simulate indirect fires. The preparation and training of OCs to support planned exercise events also varies between installations. The Senior OC for the exercise normally provides the OCs with an exercise control packet which typically contains:

- The commanders objectives for the exercise
- The units Mission Essential Task List (METL)
- The Operations Order and graphics overlays being used for the exercise
- The MEL for the exercise
- An overall evaluation synchronization matrix, indicating major events OCs need to focus on and time and place they need to be to observe these events
- Mission Training Plan (MTP) task and subtask standards for all or portions of the MEL
- The OCs names and assignments in support of the exercise
- The call signs and frequency assignments for the exercise
- The OC Control Cell location, organization, and any administrative support information

The OC studies the information before the exercise to familiarize himself with the unit's objectives. OCs typically meet before the exercise begins at the OC Control Cell for last minute information and updates from the Senior OC. The OC links up with his assigned unit at its initial field position before the operation begins, and will remain with it until the exercise is complete. After the OC arrives at the unit he can observe briefings, rehearsals, determine how well information is disseminated, compare operations orders with actual unit actions, and record behavioral observations. The OC usually records observations on pre-formatted forms in his OC packet or in his own notebook for later organization and possible input to

the AAR. There is no IS at homestation so there is no opportunity for the OC to review automated AAR products.

During the execution phase of the exercise, the OC relies heavily on observation of unit actions, the MEL, and communications with the OC Control Cell to stay current with unit operations. Unless directed by the OC Control Cell on a specific place to observe the exercise, the OC determines the best position from which to observe mission execution. The synchronization matrix provides the OC with focused events that need to be observed, and also assists him in determining the best location from which to observe these events. If the execution phase of the operation includes the use of OPFOR units, the MEL will indicate such. The primary purpose of the OPFOR at the homestations is to serve as a force that causes the player units to react and execute their plan. OPFOR vehicles at homestation are not usually visually modified to look like the expected "enemy vehicles" used at the MCTCs. When used, however, OPFOR vehicles are normally marked in some way that signifies they are OPFOR. Dismounted OPFOR forces are usually dressed in distinctive uniforms that indicate they are the enemy. The OC makes observations on the unit's execution of the mission and records his comments in his notes. The OC transfers observations and comments to pre-formatted forms for inclusion in the home station evaluation/assessment report. He visually observes the fire and maneuver techniques of the player unit engaging the OPFOR. He sees BLUFOR and OPFOR MILES equipped tactical vehicles, simulated firing and indications of a their success based on the signals from the opponents' vehicle Combat Vehicle Kill Indicator (CVKI) lights. The CVKI will blink 3-6 times to indicate a near miss, and flash continuously to show a killed vehicle.

For dismounted soldiers the OC gets an indication of successful engagements through the MILES system worn by each soldier. The Man Worn Detection Device (MWDD) harness will emit short intermittent tones to the user if they are receiving a "near miss" from a MILES equipped system. The MWDD will emit a constant tone when the soldier receives "kill" event from a MILES equipped system. The tone will not stop until an OC or other person "keys" the system to reset it. The OC will hear indications of kills, and near miss events based on the tones from the MILES systems worn by the soldiers. The OC also sees firemarkers detonating artillery simulators, indicating the impacts of indirect fires. As mission execution progresses, the OC makes notes and comments on observations of the unit's actions for future reference/use for AAR purposes.

After mission execution, the OC goes to each disabled BLUFOR vehicle and records the kill code of the OPFOR system that killed the BLUFOR vehicle. The kill code provides the type of weapon system (e.g., T80 Tank-main gun) that killed the vehicle, but does not provide the shooter player ID; i.e., the identity of the specific tank that fired the round. The OC must try to determine who the shooter was that engaged the vehicle from his notes, if possible. The OC uses the same systems and processes to determine who shot dismounted players during the engagements. There is no information on the MILES harness that shows who shot the victim, the only indication is of a kill. The OC must determine, if possible, who was killed by who, and record kills for dismounted engagements. Similarly, OPFOR units collect the kill codes from disabled OPFOR vehicles to identify the BLUFOR weapon system type that killed each OPFOR vehicle. OCs roll-up this information into killer/victim scoreboards that show the number and type of OPFOR weapon systems killed by BLUFOR weapon systems and vice versa. The OC records this information in his notes and forwards it to the OC Control Cell for later use in the AAR. The OC can now take time to analyze unit actions relative to the MTP standards provided in the OC packet. The OC makes statements about meeting standards by annotating the MTP excerpts as to whether he thinks the unit achieved a GO/NO GO for the task. This does not imply the OC is "evaluating" the unit, but simply communicates the OC's observations to the unit based on the given standard for potential use in the AAR.

The Senior OC determines when to conduct the formal TF level AAR. Each OC involved in observing subordinate units coordinates AAR times with his respective player unit at PLT and CO/TM levels. None of these AARs has the benefit of automated AAR products. The OC uses the graphic overlays issued from the operations order at the beginning of the exercise to discuss the unit plan. Before conducting the AAR, the OC transfers his key points to a "Butcher Paper Pad" and presents them during the AAR discussion. All information presented during the AAR is constructed manually by the OC for presentation to the unit. The same manual process is done in preparation for the TF level AAR. The Senior OC discusses observations with subordinate OCs and decides what to include in the formal AAR. The OC Control Cell manually constructs AAR products for the TF AAR. The AAR includes input from PLT and CO/TM OCs and a "rollup" of the important issues they observed.

The home station evaluation/assessment report usually consists of OC comments and notes, which OCs transcribe onto pre-formatted comment sheets contained in OC packets. The evaluation/assessment report also contains the OCs' assessments, i.e., GO or NO Go, as to whether or not units successfully met MTP standards. The evaluation/assessment report provides valuable feedback to unit trainers on unit strengths and weaknesses, allowing unit planners to focus their future training efforts to improve performance.

Training Operations for Normal Homestation Training Exercises

Training and training management guidance for all units within the Army is found in Field Manual (FM) 25-100. The overall training management process begins with the steps found in the training management cycle in Figure C-2.

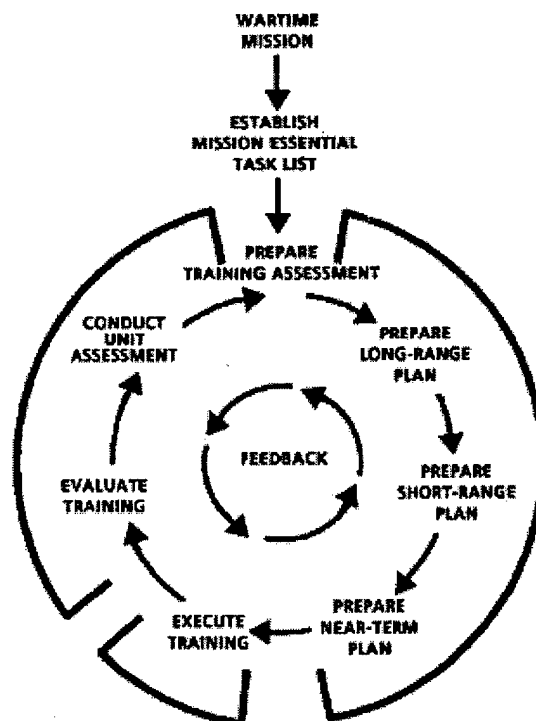


Figure C-2. Training Management Cycle (Department of the Army, 1988.)

Homestation METL Development and Battle Focus

The commander at each echelon down to CO/TM level analyzes external directives and overall missions to determine the tasks his unit must accomplish to succeed in executing its wartime mission. The commander will then research appropriate MTPs to determine the specific tasks required to achieve Army standards in support of the METL. There are a myriad of tasks and subtasks associated with MTP standards. The Army realized that it was unrealistic to expect every soldier to be proficient on all tasks required in the MTP. The concept of Battle Focused Tasks allows commanders to refine and focus training to those tasks that are critical to support the METL. The battle focus specified by the commander reduces the number of training tasks to a manageable number of critical tasks required to accomplish the wartime mission. Training the battle focus tasks to required standards then becomes the driving force in the unit's overall training program.

There are indications that METL development in general is not always done properly. Discussions with OCs at the Joint Readiness Training Center (JRTC) and the National Training Center (NTC) indicated that units are not training to standard before arriving at the MCTCs. Frequently unit METLs are not supported by correct MTP tasks, and battle focus tasks are often not identified. This problem is particularly noticeable in the staff sections. Incorrectly identified unit METL and battle focus tasks starts the entire planning process off in the wrong direction. This, in turn, results in incorrect training focus and planning for the unit, and obviously causes problems in training to standard.

Prepare Training Assessment

As stated above, if homestation commanders do not properly establish their METL and battle focus tasks, then the assessment of the units training status cannot be made against relevant, applicable standards. All commanders are responsible for assessing unit training status. The commander assesses unit training as stated in FM 25-100 "to compare the organization's current level of training proficiency with the desired level of warfighting proficiency. This desired level is defined in MTPs and other doctrinal literature" (Department of the Army, 1988). "...leaders must use all available evaluation data to develop an assessment of the organization's overall capability to

accomplish each mission essential task" (Department of the Army, 1988). The assessment of unit proficiency is absolutely critical to prioritize unit training plans.

Again, there are problems at homestation that make this process difficult to accomplish. The current environment of homestation training is austere. The OCs stated that units were lucky to train at the BN/TF level once every 12-18 months. This makes assessment at BCT/BN/TF level almost impossible. Units often consult previous evaluated exercises to determine their unit strengths and weaknesses. Unit THPs from MCTCs can show overall indications of strengths and weakness within units. The MCTC information provides commanders an indication of "major" problem areas, but does not indicate proficiency assessment at the task level. Personnel turbulence is also a factor in assessment of unit proficiency. The OCs stated that some units arrive at the MCTCs with 50% strength, and have had no BCT level training before arriving. Additionally, commanders have difficulty in assessing their unit's overall proficiency if they are at 50% strength. MCTC evaluations do not provide the level of detail called for in FM 25-100 to assess unit task level proficiency. OCs indicated that CALL publications do provide commanders with task level indicators of proficiency to help them better assess their unit's training status.

Prepare Long Range, Short Range, and Near Term Planning of Training

Units at homestations submit long range, short range and near term training plans to support training of METL tasks. Unit training cycles are based on the Green, Amber and Red time management system in FM 25-100, Training the Force and FM 25-101, Battle Focused Training.

During the Green cycle, units focus on collective task training at multi-echelon unit levels. The unit maximizes soldier participation in METL training during the Green cycle. Priority of training resources such as major training areas, local training areas, and key training ranges are provided to units in the green period and administrative support requirements are kept to a minimum. A homestation unit in the Green period should focus primarily on training collective tasks that support the METL. Typical activities during a green cycle include gunnery qualifications, field training exercises (FTX), combined arms live fire exercises, and planned rotations to one of the MCTCs (Keesling, O'Mara and Flanigan, 1994).

During the Amber cycle, units focus on small unit, crew, and individual training; however, some sub-units can conduct collective training. Soldiers may attend training and educational courses and conduct planned maintenance services for tactical vehicles. Selected personnel are diverted from training to support administrative requirements. Weapons qualifications may be scheduled during the Amber cycle.

During the Red cycle, units are oriented totally to supporting missions and tasks as required in support of other units or the installation. The unit attempts to divert the minimum number of personnel to support requirements and attempts to maintain unit integrity to exercise the chain of command. There is very little opportunity to train during the Red cycle. Any training time available is primarily for individual, leader, and crew training. During the Red cycle, the unit attempts to schedule routine medical and dental exams and annual administrative requirements. Other activities during the Red cycle may include providing OCs and OPFOR to support a sister unit evaluation or FTX.

Homestation training is usually planned well, but executed poorly. OCs, in their discussions about homestation, indicated that units are constantly being distracted from planned training. One Senior OC stated that there used to be three training cycles (Green, Amber, Red) now there are only two, Green and Red. If this is a true indication of the homestation planning process, then training standards cannot be sustained. The OCs stated that combat readiness in units coming to the MCTCs is decreasing. One OC stated units now come to the MCTCs "prepared to train instead of being trained and ready." Personnel shortages and turbulence are also affecting planned training. Some units have difficulty manning all vehicles to train at CO/TM level. Consequently, they cannot train to standard. OCs stated that another problem with units coming to NTC is that they have new equipment fielded just before they rotate to NTC, then when they get there they are not experienced enough to use it.

A recent General Accounting Office report on Military readiness, dated September 1999, specifically addressed factors that adversely affected training. The study revealed that those surveyed identified personnel shortages, high personnel turnover, and high operating tempo as the top three distractions to organized training at all levels (GAO, 1999).

Execute Training

Commanders, regardless of echelon, devise FTX scenarios that train the unit on its METL tasks. Normally, the higher headquarters of the unit undergoing the training prepares a MEL. The MEL provides exercise controllers with message inserts, orders, and information on OPFOR actions that cause subordinate units to exercise their METL tasks. The length of the FTX varies according to the echelon trained, but typically ranges from five to 14 days. Units at homestation train to specific tasks based on their training assessment. This means that units could train from BN/TF level down to squad level. In most cases, commanders determine what tasks to train, execute the training, and then assess how well the unit performed. If the unit did not meet training standards, it continues to train until the standard is met. The training at homestation is usually concentrated at CO/TM and below. Homestation training differs from the training at the MCTCs in the following ways:

- The homestation installations currently do not have an IS to gather information on units within the training area. There is no electronic means to monitor player location, status, movement, and direct or indirect-fire engagements. There is no capability to record, time-tag, and playback tactical voice and digital command, control, communications, computers, and intelligence communications. There are no video crews available to record significant unit actions, and there is no capability to electronically replay successful examples of engagements against OPFOR units.
- Homestation units typically have MILES available at the installation and may or may not use it for BLUFOR and OPFOR personnel. Although MILES provides a realistic simulation for direct fire weapons, there is no simulated area weapons effects capability to simulate indirect-fire, minefield or nuclear, biological, and chemical engagements.
- There are no dedicated OCs or OPFOR players available to support the homestation exercises. As discussed earlier, these OCs and OPFOR players usually come from a unit in a support (Red) cycle. Colonel (COL) Lynch (Commander, 1st Bde, 4th Infantry Division Digitized) has had extensive experience in training both regular and digitally equipped units within the 4th ID. He stated that one of

his main problems with homestation training was that he controlled the OPFOR during his training. He made the OPFOR attack in the same way each time, causing the unit to be totally surprised at NTC when the enemy did not perform as expected. COL Lynch stated the lack of an OC/mentor for his level at homestation precluded him from having a better assessment of his training. He was his own OC (Lynch, 1999).

- There are no TAF analysts at the homestations. The OCs have no TAF analyst counterpart to assist in analyzing unit performance or in making AAR products.
- AAR products at the homestation installations are manually prepared. The OCs at homestation record their observations of unit performance, identify key issues to discuss, and prepare their own AAR products. AAR products at homestation usually consist of:
 - Maps and overlays
 - Terrain models of the engagement constructed on the ground
 - "Butcher Paper" charts containing sketches and text
 - PowerPoint™ text slides
- Homestation maneuver areas are more restrictive than the MCTCs. At the homestation there is usually not enough room for units to train and maneuver as a BN/TF. The homestation may restrict use of certain tactical assets such as smoke generators and pyrotechnics.

Evaluate Training

The final portion of the training management cycle is the training evaluation. Commanders at all levels have significant challenges in attempting to evaluate their units. The homestation evaluation process is not consistent from unit to unit. OCs have differing degrees of expertise and are rarely certified to perform OC duties. Coupled with no instrumentation systems at homestation, units must rely exclusively on OCs and each other to accurately assess their performance.

Appendix D - Database Instructions

Overview

The TAAF-X Analyst Task Database provides the decision-maker a tool that he can use to assist in refining the TAAF-X Concept and designing TAAF-X. The database allows the user to add/delete/modify:

- Local TAF analyst functions
- Problems associated with TAAF-X implementation
- Strategies to fix or mitigate those problems
- Objectives TAAF-X is to achieve

Additionally, the database is a wargaming tool for the decision-maker. Depending on his perspective and priorities, he can wargame problem/strategy pairings (plans) as desired. The database does not identify an "approved" solution.

The Excel™ files created by Access™ must be linked to the proper sheets in Master2.xls. You must re-establish the links each time the database and main spreadsheet are moved. For example, if a file, created by Access™, must be incorporated into one of the sheets of the major Excel™ file, the file name, its location, and the proper cell must be entered. If the links are broken, the database will not function properly.

Instructions

Before using the database, create the folders c:\Transfer\TAAF X\Database (note the space between the F in TAAF and the X). Now, drag the database files (12_31_99.mdb, Master2.xls, TRIAL 1.xls, and TRIAL a.xls) into the newly created folder named Database. Right click your mouse on each file individually, selecting "Attributes". De-select "Read Only", select "Apply", then "OK". De-selecting "Read Only" will allow you to make changes to the database files.

We wrote these instructions to coincide with the main database form. We will discuss how to use the database going down the main database form and in the sequence the user should execute the operations.

Add/Edit/Delete Basic Data

Open Access 97™ and then the TAAF-X database file. The form you see connects you to the rest of the database (See

Figure D-1). After reading the form, select the Excel™ button on the form to open Excel™. Next, open the file c:\Transfer\TAAF X\Database\Master2.xls. When the question of opening the file and enabling the macros appears, select "Enable Macros". When the question to update the file is asked, select "No". Read and perform the instructions on the Instructions page (See Figure D-2). Once complete, minimize (-) Excel™ and return to Access™. To add/edit/delete functions, problems, or strategies, click on the appropriate button (See Figures D-3 - D-6). This action will take you to the item you wish to modify. Once you have made your desired modifications, close all forms except the original form entitled "The TAAF-X Problems/Strategies Database".

Edit/Enter Basic TAAF-X Data - Form

The TAAF-X Problems/Strategies Database

Edit/Enter Basic TAAF-X Data

Edit/Enter TAAF-X Objectives

Edit/Enter TAAF-X Problems

Edit/Enter Possible Strategies to TAAF-X Problems

Edit/Enter All Associated TAAF-X Functions

Relate Problems, Strategies, Objectives, and Functions

Select Strategies for Problems

Review/Print Reports

Note: If you are going to select solutions for problems, first open Excel by clicking this button → then open the file: Master 2.xls, enable macros but do not update. Now you may begin to relate problems and solutions. Once you have completed the relations and have clicked the button, go to the Excel file mentioned at the beginning. Go to the Instructions sheet there and read the instructions before proceeding further.

X

OK

Figure D-1. Main TAAF-X database form.

Edit/Enter Basic TAAF-X Data Form

The TAAF-X Problems/Strategies Database

Edit/Enter Basic TAAF-X Data

Edit/Enter TAAF-X Objectives

Objectives

TAAF-X Objectives Edit/Entry Form

TAAF-X Objective

Allow a single facility to support several, simultaneous field training exercises

Record: 14 of 11

Review/Print Reports

Note: If you are going to select solutions for problems, first open Excel by clicking this button → then open the file: Master 2.xls, enable macros but do not update. Now you may begin to relate problems and solutions. Once you have completed the relations and have clicked the button, go to the Excel file mentioned at the beginning. Go to the Instructions sheet there and read the instructions before proceeding further.

Figure D-3. Form to enter/edit objectives.

Edit/Enter Basic TAAF-X Data Form

TAAF-X Concept Problems Edit/Entry Form

Problem

CTC mini-TAF analysts and homestation analysts will have to coordinate with TAAF-X for AAR products. LA (NTC comments)

Problem Category Total Problem Score

Serious 75

Problem Narrative

Currently, CTC TAF analysts produce their own AAR products. These products are created during all phases of the rotation. When one of the 5 supported OCs request an AAR product, the military analyst of the military/civilian analyst team, receives the request. The military analyst decides what the AAR product should look like and gives the civilian analyst a sketch to show what the OC wants. The civilian analyst can immediately make the aid. With TAAF-X, the CTC mini-TAF analyst/homestation analyst becomes the relay point for AAR product creation between the OC and the TAAF-X analyst. He will have to compete with two or more other analysts, each supporting 5 or more OCs, for TAAF-X AAR product support. The CTC mini-TAF analyst/homestation analyst will have to take time to explain who he is, what unit he is working with, what type of aid is to be produced, and what other information must be included in the aid. Additionally, he may have to wait his turn if other analysts are talking to his TAAF-X analyst. While the CTC mini-TAF homestation analyst is performing this coordination, the exercise is continuing, causing him to possibly miss critical events. This is especially true if the military half to the CTC TAF team is removed and the civilian must coordinate for AAR aids and perform exercise control. An untrained or partially trained homestation analyst may be even more overwhelmed.

Select the Area Affected by the Problem

CTC Problem? Homestation Problem?

Area Score: 15

Problem Category Score: 5

Record: 14 of 16

Figure D-4. Form to enter/edit problems.

TAAAF-X Concept Strategies Edit/Entry Form

Strategy
 Apply Embedded Simulation to Mounted Direct-Fire Systems for Point Target Engagements (ATESC)

Narrative
 If position location technology in live training matures to the point that actual location equals instrumented location, embedded simulation can automate mounted direct-fire assessments without the use of laser transmitters and receivers. Embedded simulation permits the vehicle to serve as a simulator as well as a tactical platform. Under this concept, the weapon platform has embedded sensors, which determine vehicle location, tube azimuth, tube elevation and type ammunition fired. Vehicle sensors transmit fire control data through the IS to a simulation model. Using the fire control data, the simulation model calculates the "should hit" location for the ammunition fired and automatically assesses casualty or battle damage against player entities in the target area. The victim receives an indication of a hit or near miss through his VDD or PDD and an engagement vector appears on the screen of the TAF analyst workstation depicting a shooter-to-victim or shooter-to-miss pairing. This strategy also provides virtual imagery and sound to depict terminal ordinance effects for direct-fire signatures, hits and misses as discussed in the strategy Virtual Simulation of Artillery and Mortar Battlefield Effects. This strategy would automate 30 currently required OC and TAF analysts functions and reduce workload by 13%.

Reduces TAAAF-X Analyst Workload ☐ Use Beyond TAAAF-X ☒

Record: 14 of 31

Figure D-5. Form to enter/edit strategies.

TAAAF-X Concept Functions Edit/Entry Form

Function: Administratively assess affected vehicle(s) with mobility kills from TAF CHKD

Extrinsic Function ☐ **Intrinsic Function** ☒ **TAF Analyst Function** ☒ **TAAAF-X Analyst Function** ☐

Trainer Location: TAF

Task Complexity
 Cognitive ☒ Man-Machine Interface ☒ Human Coordination ☒ Navigation ☐ Physical ☒ Complexity Score: 13

Task Completion Time: 25 Minutes **Personnel Performing:** 2

Times Performed: 5-10 Times **Training Required:** Less than 1 Hour

Distractions: Trainer distracted for 25 minutes **Function Total:** 45

Overwhelm Probability: Little potential

To enter new functions: 1) Go to the bottom of the page and click on the arrow star. 2) Type in the next Function Number (they are in order) fill in all of the yellow portions on the form. The system will automatically enter the Function Number into the area where you type in Function Name. 3) Go back to 1 and continue until complete.

To edit functions: 1) Go to the bottom of the page and click on the arrow until you find the function. 2) Make any corrections or edits. 3) Go back to 1 and continue until complete.

Record: 14 of 138

Figure D-6. Form to enter/edit functions.

Modify Data Pairings

To modify the pairings of strategy and objective, strategy and function, or strategy and problem, click on the fifth button from the top (See Figure D-7). Doing so will bring up another form to allow you to go to the specific pairing group you wish to modify (See Figure D-8). Once you select one of the three choices, the appropriate form will appear, allowing you to modify items within that pairing (See Figures D-9 through D-11). Once you have made your desired modifications, close all forms except the original form entitled "The TAAF-X Problems/Strategies Database".

Edit/Enter Basic TAAF-X Data: Form

The TAAF-X Problems/Strategies Database

Edit/Enter Basic TAAF-X Data

Edit/Enter TAAF-X Objectives

Edit/Enter TAAF-X Problems

Edit/Enter Possible Strategies to TAAF-X Problems

Edit/Enter All Associated TAAF-X Functions

Relate Problems, Strategies, Objectives, and Functions

Select Strategies for Problems

Review/Print Reports

Note: If you are going to select solutions for problems, first open Excel by clicking this button → then open the file: Master 2.xls, enable macros but do not update. Now you may begin to relate problems and solutions. Once you have completed the relations and have clicked the button, go to the Excel file mentioned at the beginning. Go to the instructions sheet there and read the instructions before proceeding further.

Figure D-7. Main TAAF-X database form.

Relate Basic Data

Relate Strategies with TAAF X Objectives

Relate Strategies with Functions

Relate Problems and Strategies

OK

Figure D-8. Main form to pair database elements.

Solutions and Objectives Pairing : Form

TAAF X Objectives and Strategies Pairing Edit/Entry Form

Strategy

Objective Addressed by the Strategy

Redistribute CTC TAAF (sic) analysts to observer/controller positions (at the time of the report, analysts were military; however, they are now contracted civilians).

Record: 14 1 of 149

OK

Figure D-9. Form to edit/pair objectives and strategies.

Solution and Functions Pairing : Form

TAAF-X Concept Strategies and Functions Pairing Edit/Entry Form

Strategy Apply Embedded Simulation to Mounted Direct-Fire Systems for Point Target Engagements. (ATESC)

Function Compile total Avenger shots taken from all OC's and provide information to DTDC counterpart for casualty assessment. **CHKD**

Function Assisting/Satisfied by Strategy

Select One

Does the Strategy Assist in Satisfying the Function? ☐

Does the Strategy Completely Satisfy the Function? ☒

Function Score	Workload
45	45

Record: 14 of 217

Figure D-10. Form to edit/pair strategies and functions.

Problem and Solution Pairing : Form

TAAF-X Problems and Strategies Pairing Edit/Entry Form

Problem CTC TAF analyst loses local flexibility to produce AAR products. LA (NTC comments), OK.

Strategy Automate the production of DC discussion outlines which address the significance of each AAR product. (CRIOT).

Record: 14 of 158

Figure D-11. Form to edit/pair problems and strategies.

Create Your Plan

To select the strategies and problems you want to consider in your plan, select the sixth button (See Figure D-12). Your selection will cause a form to appear that contains all of the strategies and problems that you have paired (See Figure D-13). To select a strategy/problem pair, click in the box next to the statement "Check here if you want to use this strategy for the problem". Selection tells the database to use this pairing in its calculations for your plan. Once you have completed your selection(s) for your plan, click on the Excel™ button. For each question asked by Access™ concerning over-writing files, select "Yes". Now you are looking at TRIAL a.xls. Minimize this file (-) and open c:\Transfer\TAAF X\Database\TRIAL 1.xls. Minimize this file (-) and maximize Master2.xls. By opening/creating/over-writing the files TRIAL a.xls and TRIAL 1.xls with Master2.xls open, Master2.xls is automatically modified with the new information. Continue following the instructions on the Instructions page (See Figure D-14). After saving Master2.xls, return to Access™, close the top form and save the database. This saves the new data created in Master2.xls in the database. Now close Excel™ and return to Access™.

The TAAF-X Problems/Strategies Database

Edit/Enter Basic TAAF-X Data

Edit/Enter TAAF-X Objectives

Edit/Enter TAAF-X Problems

Edit/Enter Possible Strategies to TAAF-X Problems

Edit/Enter All Associated TAAF-X Functions

Relate Problems, Strategies, Objectives, and Functions

Select Strategies for Problems

Review/Print Reports

Note: If you are going to select solutions for problems, first open Excel by clicking this button → then open the file: Master 2.xls, enable macros but do not update. Now you may begin to relate problems and solutions. Once you have completed the relations and have clicked the button, go to the Excel file mentioned at the beginning. Go to the instructions sheet there and read the instructions before proceeding further.

Figure D-12. Main TAAF-X database form.

Problem and Solution Selection : Form

TAAF-X Select Strategies for Problems

Problem: CTC mini-TAF analysts and homestation analysts will have to coordinate with TAAF-X for AAR products. LA (NTC comments)

Problem Score: 75 **NOTE: Problem score range is from 5 to 150**

Strategy: Automate the production of OC discussion outlines which address the significance of each AAR product. (CRIOT)

Strategy Score: 152

Record: 14 1 of 8 (Number of Functions Associated with Strategy)

☒ Check here if you want to use this strategy for the problem

When you have finished pairing problems with strategies, press this button

Record: 14 1 of 194

Excel file mentioned at the beginning. Go to the instructions sheet here and read the instructions before proceeding further.

Figure D-13. Form to select strategies for problems.

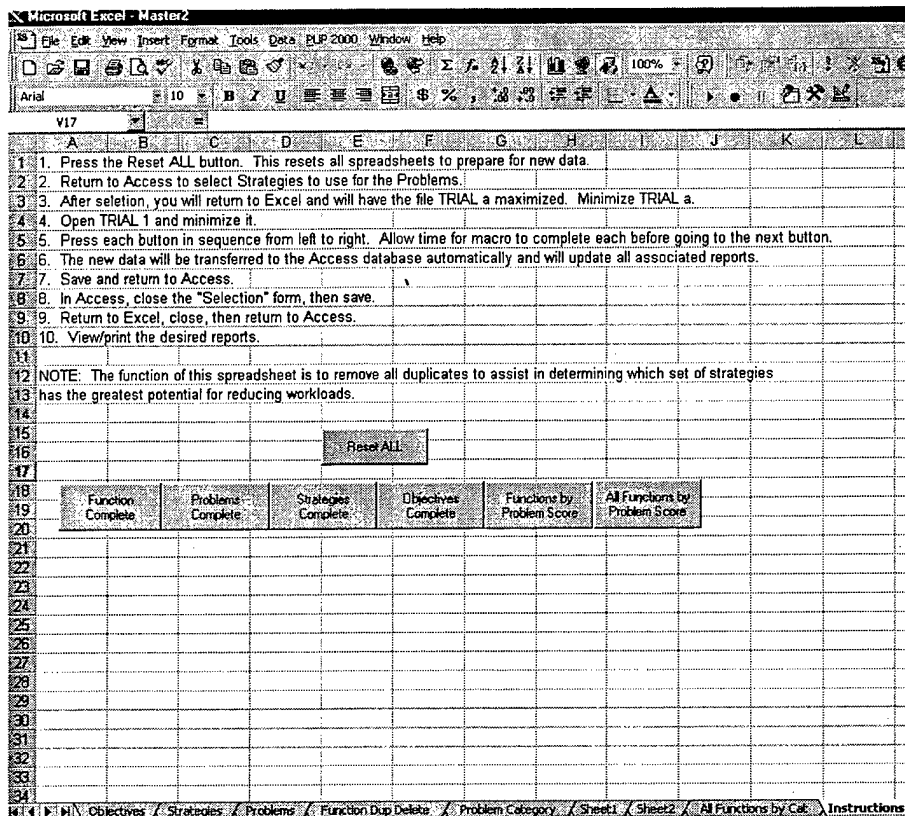


Figure D-14. Master2.xls instructions.

View and Print Database Information

To view and/or print reports, select the last button on the original form (See Figure D-15). This action will bring up another form containing two buttons, "General Data Reports" and "Strategy Data Reports" (See Figure D-16). Selecting "General Data Reports" will cause a form to appear, giving you choices to either view or print information within the database that has not been manipulated (See Figure D-17). Selecting "Strategy Data Reports" will cause a form to appear, giving you choices to either view or print information within the database that has been manipulated - giving results of your selection of strategies to fix problems (See Figure D-18).

Edit/Enter Basic TAAF-X Data - Form

The TAAF-X Problems/Strategies Database

Edit/Enter Basic TAAF-X Data

- Edit/Enter TAAF-X Objectives
- Edit/Enter TAAF-X Problems
- Edit/Enter Possible Strategies to TAAF-X Problems
- Edit/Enter All Associated TAAF-X Functions
- Relate Problems, Strategies, Objectives, and Functions
- Select Strategies for Problems
- Review/Print Reports

Note: If you are going to select solutions for problems, first open Excel by clicking this button → then open the file: Master 2.xls, enable macros but do not update. Now you may begin to relate problems and solutions. Once you have completed the relations and have clicked the button, go to the Excel file mentioned at the beginning. Go to the instructions sheet there and read the instructions before proceeding further.

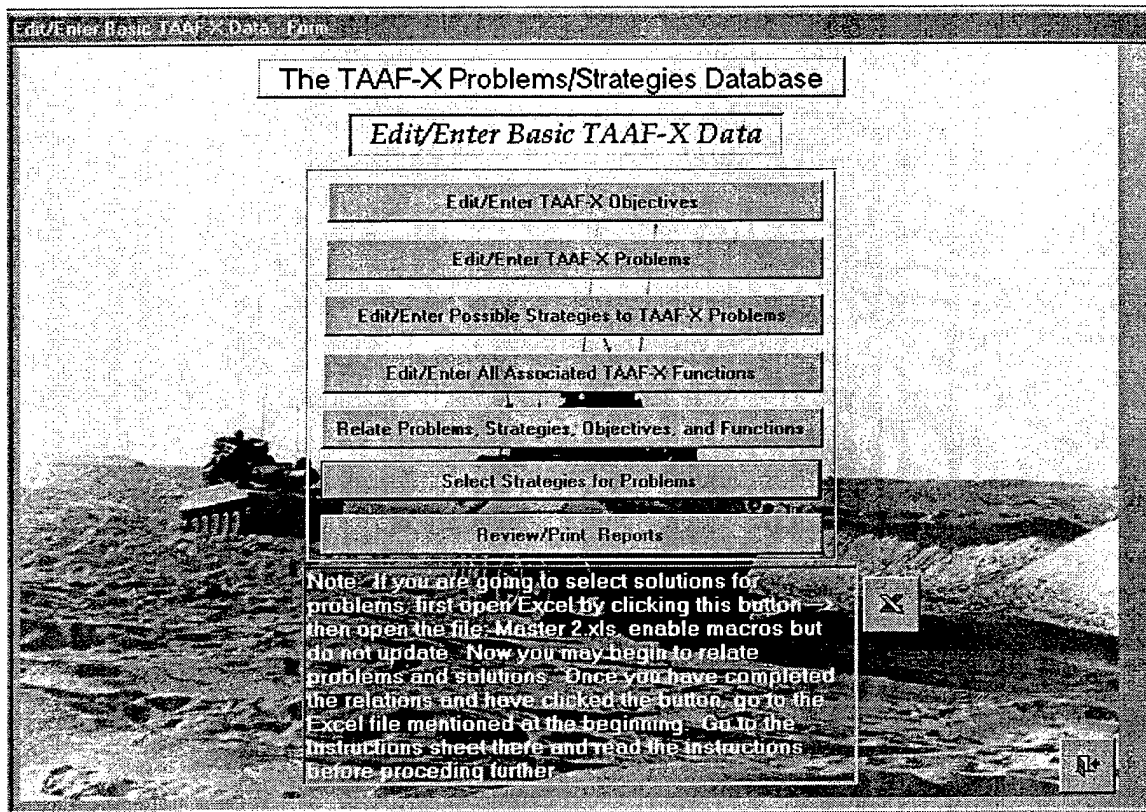


Figure D-15. Main TAAF-X database form.

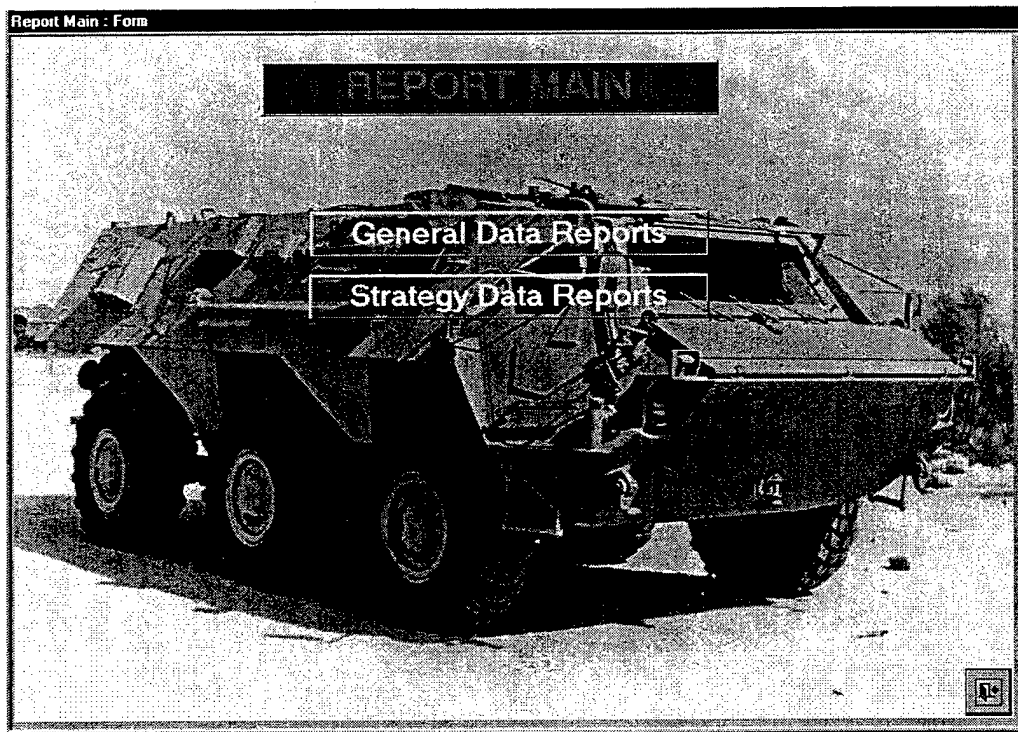


Figure D-16. Main report form.

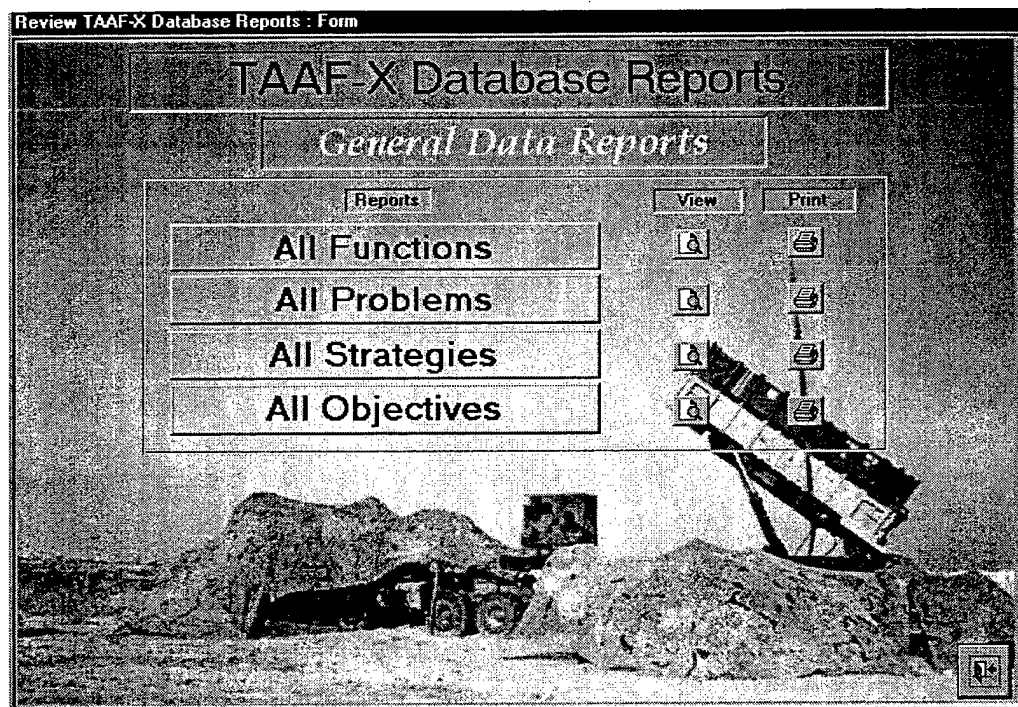












Figure D-17. Form for viewing/printing general data reports

Report Strategy Data Reports Form

TAAF-X Database Reports

Strategy Data Reports

Reports	Preview	Print
Overall Strategy Report		
Functions in Strategy		
Problems in Strategy		
Objectives in Strategy		
All Strategies in Strategy		

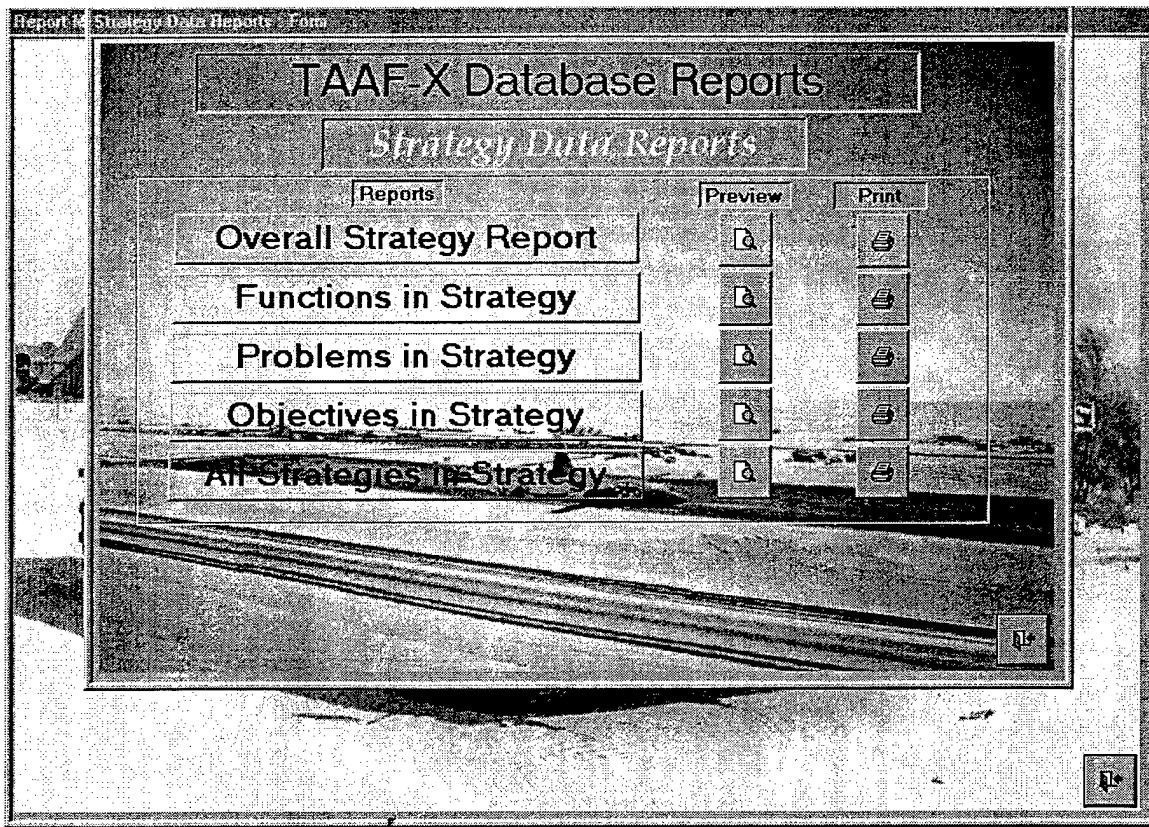


Figure D-18. Form for viewing/printing plan specific data reports.